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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

Each major division is further divided into as many as nine specific categories, which are identified by category numbers.

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Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

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Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

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Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

06 AIRCRAFT INSTRUMENTATION 1134

Includes cockpit and cabin display devices; and flight instruments.

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07 AIRCRAFT PROPULSION AND POWER 1134

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

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Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*.

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For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

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20 SPACECRAFT PROPULSION AND POWER 1143
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For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

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23 CHEMISTRY AND MATERIALS (GENERAL) 1144
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24 COMPOSITE MATERIALS 1144
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25 INORGANIC AND PHYSICAL CHEMISTRY 1147
Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.
For related information see also *77 Thermodynamics and Statistical Physics*.

26 METALLIC MATERIALS 1149
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27 NONMETALLIC MATERIALS 1152
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28 PROPELLANTS AND FUELS 1154
Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.
For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion*.

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Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.
For related information see also *Physics*.

31 ENGINEERING (GENERAL) 1155
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32 COMMUNICATIONS 1158
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Includes elementary and nuclear particles; and reactor theory.
For space radiation see *93 Space Radiation*.

74 OPTICS 1237
Includes light phenomena.

75 PLASMA PHYSICS 1238
Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

76 SOLID-STATE PHYSICS 1241
Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

77 THERMODYNAMICS AND STATISTICAL PHYSICS 1244
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 1244
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 1245
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software*.

83 ECONOMICS AND COST ANALYSIS 1246
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE N.A.
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 1246
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 1249
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS N.A.
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 1250
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 1250
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 1251
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL 1251

Note: N.A. means that no abstracts were assigned to this category for this issue.

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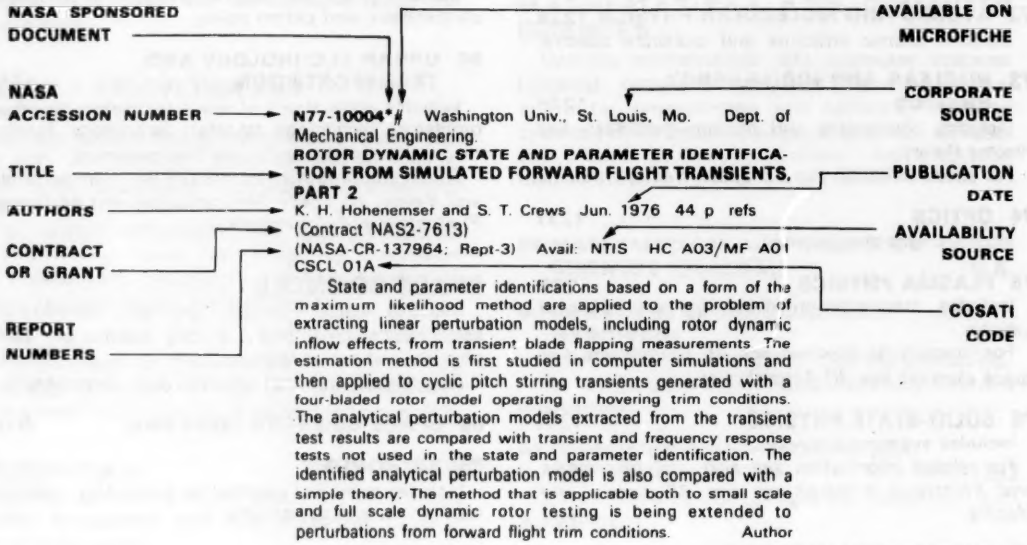
TYPICAL CITATION AND ABSTRACT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N77-10004*# Washington Univ., St. Louis, Mo. Dept. of Mechanical Engineering.
TITLE
ROTOR DYNAMIC STATE AND PARAMETER IDENTIFICATION FROM SIMULATED FORWARD FLIGHT TRANSIENTS, PART 2
PUBLICATION DATE
AUTHORS
K. H. Hohenemser and S. T. Crews Jun. 1976 44 p refs
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State and parameter identifications based on a form of the maximum likelihood method are applied to the problem of extracting linear perturbation models, including rotor dynamic inflow effects, from transient blade flapping measurements. The estimation method is first studied in computer simulations and then applied to cyclic pitch stirring transients generated with a four-bladed rotor model operating in hovering trim conditions. The analytical perturbation models extracted from the transient test results are compared with transient and frequency response tests not used in the state and parameter identification. The identified analytical perturbation model is also compared with a simple theory. The method that is applicable both to small scale and full scale dynamic rotor testing is being extended to perturbations from forward flight trim conditions. Author

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, AIRCRAFT WEAPON AERODYNAMIC INTERFERENCE

F.W. MARTIN, Auburn University, School of Engineering, *Auburn, Alabama* 36830 (DF626560; F08635-76-C-0079)

To develop a theoretical technique for accurately predicting the aerodynamic forces and moments acting on a weapon shape in the immediate vicinity of its captive carriage postion on the parent aircraft. Particular attention will be given to the influence of bomb racks and other weapons remaining on multiply configured bomb racks from which the weapon of interest was released. These data will be used in conjunction with a six degrees of freedom trajectory simulation program for prediction of weapon separation trajectories.

The technique will utilize potential flow theory in the cross flow plane. Mathematical models of weapon bodies will be analyzed simultaneously by successive applications of the Milne-Thompson circle theorem and the forces and moments will be calculated by applying the Cauchy residue theorem to the Blasius theorem. An unfinned two-body problem will be analyzed, the solution will be extended to three bodies and finally a no-body problem, a finned body will be represented by an equivalent body of revolution, the triple ejector rack will likewise be simulated, etc. until a sufficient amount of the hardware remaining attached to the parent aircraft is included in the solution to yield acceptable results. Subsequently, the flow regime will be extended to the compressible subsonic, supersonic, and transonic. Wind tunnel data will be collected to evaluate and refine the theoretical technique. Aerodynamic force and moment data will be obtained with wind tunnel models of the actual weapon and wind tunnel models of the mathematical model. These data will be compared with the purely theoretical forces and moments calculated using the math model. Also, a limited number of separation trajectories will be obtained in the wind tunnel for comparison with trajectories calculated using the theoretical technique.

ADDENDA: Supporting agency address is: AF Armament Laboratory DLJC, Eglin AFB, Fla 32542

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0002, STRUCTURAL DYNAMIC RESPONSE OF GENERAL AVIATION FIXED-WING AIRCRAFT SUBJECTED TO A SURVIVABLE CRASH ENVIRONMENT

UNKNOWN, Lockheed Aircraft Corporation, *Burbank, California* 91503 (FA58659; FA75WA-3707)

Tasks include: 1) Devise a three-dimensional lumped mass mathematical model for application to the structural design and analysis of small, propeller-driven, general aviation airplanes subjected to a survivable crash environment. The mathematical model shall be capable of predicting dynamic structural response of the airplane; i.e., forces, velocities, accelerations, displacement, etc., along the three axes, in a survivable crash. The model shall output sufficient data to assess extent of structural damage to survivable envelope of cockpit/cabin, including loads, stresses and deformations along the main structural load paths. 2) Use full-scale crash test to verify the mathematical model. An optimum conceptual configuration will be chosen.

SUPPORTED BY U.S. Dept. of Transportation - Off. Sec.

1.0003, UNSTEADY FLOWS IN AIRCRAFT PROPULSION SYSTEMS

M.F. PLATZER, U.S. Navy, Postgraduate School, *Monterey, California* 93941 (DN498064)

The objective of this work unit is the investigation of unsteady flows in aircraft propulsion systems. Primary emphasis will be given to the analysis of unsteady transonic and supersonic flows through oscillating compressor cascades.

The theoretical analysis of transonic/supersonic unsteady cascade flows is being based on the transonic nonlinear small perturbation equation using method of characteristics, collocation, Fourier and Laplace-transform techniques. The experimental part of the program is directed toward the investigation of the jet spreading characteristics of oscillating jets.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D.C.

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0004, EJECTOR TECHNOLOGY DEVELOPMENT FOR AIRCRAFT PROPULSION

M. ALPERIN, Flight Dynamics Research Corp., *Van Nuys, California* 91406 (DN696806; N00140-76-C-0542)

Conduct exploratory development program to design, fabricate and calibrate a hot gas, low volume ejector model. Thrust augmenting ejectors appear to have a good potential for VTOL and other low-speed propulsion applications.

Conduct tests on the existing model and analytical investigations to define the hot model design parameters. In addition, improvements to the ejector end performance and reduction of primary flow to the diffuser will be explored. Fabricate a hot gas model with cold gas augmentation ratio of about two. Hot gas testing (800 degrees F) will be conducted at the Naval Air Propulsion Test Center.

ADDENDA: Supporting agency address is: Naval Air Propulsion Test Center Project Engineering Group (PE6), Trenton, N.J. 08628

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0005, DEVELOPMENT OF AN AUTOMATED ADAPTIVE TRAINING SYSTEM FOR BASIC INSTRUMENT FLIGHT

R.M. JOHNSON, Appli Mation Incorporated, *Orlando, Florida* 32803 (DN494029; N61339-74-C-0141)

Develop a refined and expanded version of an automated adaptive instruction module for basic instrument flight training as presented in ground-based simulators. For purposes of preceding studies, in which the technical feasibility of implementing automated adaptive methodology was demonstrated, a training course made up of isolated tasks loosely derived from typical syllabi was adequate. Prior to implementation for testing in an operational environment, however, it is appropriate to supplement earlier findings by demonstrating a system utilizing a complete automated syllabus closely corresponding to current syllabi in use at operational training sites.

Conduct a thorough analysis of current syllabi in operational use by training squadrons; design and implement a training course to reflect impact of automated adaptive techniques and to cover the full range of tasks and skills which can be realized by synthetic training for basic instrument flight; install and demonstrate the system on the Naval Training Equipment Center's TRADEC (research simulator) facility; carry out an evaluation experiment to measure effectiveness.

ADDENDA: Supporting agency address is: Naval Training Equipment Center, Human Factors Lab, Orlando, Fla.

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0006, FLUERICS/FLUIDICS FOR NAVY AIRCRAFT AND MISSILE SYSTEMS

G.W. ROE, McDonnell Douglas Corporation, *Titusville, Florida* 32780 (DN581113; N62269-74-C-0723)

To develop an environmentally compensated hydrofluidic laminar angular rate sensor (LARS) which will be usable in aircraft and missile control systems. This contract supports work unit PH101, Agency Accession No. DN833162.

The program will include the following tasks: A. Optimize current pneumatic LARS configuration and incorporate improvements recommended as a result of laboratory evaluation performed under Contract No. N00019- 73-C-0265. B. Design and fabricate a hydrofluidic LARS based on optimized pneumatic configuration. C. Investigate the comparative advantages of an axisymmetric hydrofluidic LARS.

ADDENDA: Supporting agency address is: Naval Air Development Center, Air Vehicle TTchnology Dept. (30424) Warminster, Pennsylvania 18974

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0007, HEAT TRANSFER PROBLEMS IN GAS TURBINES AND HEAT EXCHANGERS

E.R. ECKERT, Univ. of Minnesota, School of Engineering, *Minneapolis, Minnesota* 55414 (DN823027; N00014-76-C-0246)

To acquire detailed understanding and predictive capabilities of heat transfer under conditions of fluid flow in gas turbines and heat exchangers. These objectives are important to obtaining improved performance of ship and aircraft propulsion systems with particular relevance to improved power/weight ratios and fuel consumption.

This work consists of experimentation and analytical development in the areas of film and impingement cooling of gas turbine blades, turbulence measurements in turbine gas flows, and localized heat transfer in heat exchangers.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, Va 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0008, PREDICTIVE METHODS FOR MULTIPLE-JET LIFT CHARACTERISTICS OF V/STOL AIRCRAFT

D.R. KOTANSKY, McDonnell Douglas Corporation, *St. Louis, Missouri* 63166 (DN781210; N62269-76-C-0086)

The objective of this contract is to develop a comprehensive theoretical/empirical investigation of the propulsion-induced effects of V/STOL jet flows on the lift and moment characteristics of a vehicle. This contract supports work unit RJ 801, Agency Accession No. 681201

This effort is anticipated to require a three phase study which will include all V/STOL flight applications: hover (in/out ground effect?) and aircraft/deck movement. Major emphasis will be concentrated on a combined study of theoretical and semi-empirical prediction methodology for estimation of the induced forces and moments on an arbitrary aircraft configuration. The study will be augmented by model testing as required. Effects of wing/fuselage planform, jet location and spacing, flow parameters and model scaling on the vehicle lifting characteristics will be addressed as the major topics.

ADDENDA: Supporting agency address is: NADC, Air Vehicle Technology Dept., Warminster PA.

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0009, LAUNCH AND RECOVERY SAFETY DEVICES

T. GIOIA, U.S. Navy, Engineering Department, *Lakehurst, New Jersey* 08733 (DN696000)

The hectic pace of launching and recovery operations aboard aircraft carriers periodically result in accidents which cause injury or loss of life to personnel and damage or loss of aircraft and/or equipment. To reduce the possibility of these operational accidents, three areas concerning aircraft launching or recovery operations are under investigation and development. These are: (1) to develop optimized jet personnel and aircraft; (2) to develop high-strength, lightweight Dupont 'kevlar' cables and tapes for launch and recovery system use; and (3) to develop various warning systems to alert a pilot that a dangerous condition (such as bridle shedding) has occurred during catapulting of an aircraft.

The approach will be as follows: (1) Advanced jet blast deflector (JBD) conduct comprehensive analytical study and scale-model tests to analyze jet blast flow around various JBD configurations to define optimum system. Utilizing this data, design prototype system for full- scale land-based tests. (2) High-strength textile cables - develop 'kevlar' weaving and cable technology to obtain the optimum cables and tapes to suit particular launching and recovery application. This includes development of composite constructions as well as appropriate end terminals. Manufacture and test prototype samples. (3) Aircraft runaway launch signal - conduct studies of all types of warning devices and develop technology of systems which can actuate instantly to warn the pilot when a runaway launch occurs. Establish design parameters for such systems.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0010, V/STOL GSE STUDY

W. WOMER, U.S. Navy, Air Engineering Center, *Lakehurst, New Jersey* 08733 (DN696011)

Conduct a support engineering analysis of the V/STOL type aircraft to determine support suitability of existing GSE or requirement specifications for new equipment. Analysis will also extend to support requirements for 'advanced systems' aboard such aircraft, e.g.: composites, high-press hydraulics, etc.

Two phase program. Phase 1 will define support requirements for the v/stol type aircraft. Phase 2 will apply the concepts developed in phase 1 to GSE, existent and required as a result of the study.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0011, APPROACH POWER COMPENSATOR SYSTEM CHARACTERISTICS AND FLYING QUALITIES OF NAVY AIRCRAFT

R.A. ROSSI, Princeton University, Off. of Research & Proj. Adm., *Princeton, New Jersey* 08540 (DN590080; N00019-75-C-0528)

Determine how variations in the characteristics of approach power compensator system interact with the flying qualities of Navy aircraft in the carrier approach.

Continue investigation of interaction between approach power compensator system characteristics and the flying qualities of navy aircraft in the carrier approach using the Princeton variable stability NAVION.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0012, PROGRAM COORDINATION AND ANALYSES

E. LISTER, U.S. Navy, Air Propulsion Test Center, *Trenton, New Jersey* 08641 (DN596804)

To formulate and technically direct air-breathing propulsion and propulsion-oriented exploratory development programs for NAVAIR. Coordinate Navy Cat. 6.2 with other government and NASA efforts. Provide transition of Cat. 6.2 efforts into Cat. 6.3.

Coordinate with Air-330 and Air-536 to establish short- and long- range exploratory development (EDP) and advanced development program plans. Prepare EDP planning. Solicit ideas, plans, and proposals from government and industry. Evaluate these inputs in light of the overall EDP plan. Formulate plans and recommend sufficient funding to support the required efforts. Coordinate with other government organizations to optimize the effectiveness of all programs. Review IRAD (brochure and on-site) proposals. Participate in tri-service technical meetings.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Propulsion Technology Administrator, Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0013, INVESTIGATION AND DEVELOPMENT OF SYSTEM AND TECHNIQUES FOR PERSONNEL PROTECTION FROM EJECTION IN 400-600 KT SPEED RANGE

S. CORYELL, Grumman Corporation, *Bethpage, New York* 11714 (DN781125; N62269-76-C-0082)

Investigate and develop systems and/or techniques to provide personnel protection from aerodynamic forces in the 400 to 600 knot speed range.

The approach will follow various phases of investigation of requirements, design concepts and component development and evaluation studies. This apporach will define the aerodynamic and deceleration forces developed on the man/seat/recovery system and the resulting effects on the aircrew, equipment, and escape system performance. It will then allow development of the necessary equipment and seat orientation requirements to insure maximum protection against the deceleration and g forces in the 400-600 knot range without degrading lower speed range performance.

ADDENDA: Supporting agency address is: NADC, Crew Systems Dept., Warminster, PA

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0014, MECHANICAL POWER TRANSMISSION COMPONENTS FOR NAVAL AIRCRAFT

A. ANKENY, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN833210)

The objectives of this effort are to develop new self-lubricating bearing materials for use in helicopter rotor head control links which will increase life by 50 percent, improve reliability, reduce maintenance through improvements in wear resistance for a total cost saving in excess of $700,000 per year.

Investigate wear resistance of ten self-lubricating materials under simulated environmental conditions. Tests would include conditions of dust, water and various aircraft fluids with oscillatory motion under constant and cyclically varying load. Based on the results of these tests, determine a preferred material and provide samples for evaluation in a helicopter. Work is also being performed on contract as reported in work unit DK603B.

ADDENDA: Supporting agency address is: Naval Air Systems Command, (340C), Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0015, DYNAMIC FLIGHT SIMULATION OF V/STOL OPERATIONS AND DETERMINATION OF FEASIBILITY

E. FESSENDEN, U.S. Navy, Crew Systems Department, *Warminster, Pennsylvania* 18974 (DN681274)

To determine those acceleration conditions encountered in V/STOL operations that contribute to operator control problems. To assess specific problems of operator control and to determine the feasibility of dynamic flight simulation in studying the interactions of flight dynamics, sensory information and operator response characteristics in the control of V/STOL aircraft.

(1) Determine acceleration conditions encountered in V/STOL operations, particularly during hover and transition phases of flight. (2) Conduct interviews, develop questionnaires, and consult technical/operational personnel regarding control problems encountered in V/STOL operations. (3) Conduct literature searches on the effects of accelerations determined above on the sensory/response characteristics of human operators. (4) Assess the feasibility of centrifuge dynamic flight simulation (open and closed loop) for investigation of the problem. (5) Conduct specific dynamic flight simulations of V/STOL operations. The thrust vector control will be added to an existing aircraft and available space will be reduced to conform to the smaller V/STOL aircraft. Our first effort will simulate motion only. However, the option of including additional displays such as HUD in the cockpit at a later date (when expanded computer capability is available) will be kept open. The cockpit will be V/STOL dedicated.

ADDENDA: Supporting agency address is: Naval Air Development Center, Warminster, PA

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0016, FLIGHT LOADS SPECTRUM SURVEY FOR RH-CLASS HELICOPTERS

F.G. NEGRO, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN781209)

Obtain flight test data to ascertain the operational spectrum of RH-class helicopter flight maneuver loads during airborne mine countermeasure operations, specifically towing mine countermeasure sleds. These data are needed to establish helicopter airframe design strength criteria for these missions to preclude fatigue failures in critical structural and dynamic components.

Four RH-53D helicopters will be instrumented and prepared to obtain maneuver load data during mine countermeasure and other towing and extraordinary operations. Direct liaison with fleet helicopter squadron HM-12 shall be established and maintained as necessary to obtain the required data. Develop suitable techniques and equipment to measure eighteen flight maneuver parameters using dual oscillographs. Parameters to be monitored include stick positions, control surface positions, environmental conditions, engine parameters, altitude, accelerations, cable tension and tow angle, etc. A total of approximately 100 hours of flight time shall be monitored for the RH-53D helicopters using conventional sleds.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Airframe Div., Washington, DC.

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0017, HIGH-TEMPERATURE-RESISTANT THERMOPLASTIC STRUCTURAL ADHESIVE SYSTEM

J.T. HOGGATT, Boeing Company, *Seattle, Washington* 98108 (DN590092; N00019-76-C-0170)

To evaluate commercially available/experimental thermoplastic, temperature-resistant adhesive for fabricating structural components on Navy aircraft exposed for extended periods in hostile environments.

The contractor shall test the most promising high-temperature- resistant, thermoplastic adhesive systems as candidates for fabricating structural assemblies on Navy aircraft exposed to high temperatures in hostile environments.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, SATELLITE COMMUNICATIONS

V. ZURICK, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (90004057)

PROJECT OBJECTIVE: 1. To determine ERL satellite communication requirements and to demonstrate application of existing satellite facilities to fulfillment of those needs. 2. To formulate a long-range plan for implementation of satellite communication systems.

CURRENT YEAR PLAN: 1. Install on a temporary basis satellite terminals at NOAA Hdqtrs. and ERL Hdqtrs. for demonstration. 2. Negotiate working agreements with Univ. of Colo., HEW, VA, and NASA for cooperative use of their satellite communication facilities.

SUPPORTED BY U.S. Dept. of Commerce - N.O.A.A.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, NAVY VEHICLE DESIGN AND CONSTRUCTION - MICROSTRUCTURE IN TITANIUM ALLOYS

K. ONO, Univ. of California, School of Engin. & Appl. Sci., *Los Angeles, California* 90024 (DN675050; N00014-75-C-0889)

Beta titanium alloys have great potential for use in aircraft structures because of their deep hardenability and ductility. The mechanical properties of these alloys depend on the structures developed through compositional control, heat treatment, and processing. This research is aimed at improved understanding of structure development as related to the above factors.

The influence of external stress on the preferential precipitation of alpha phase in beta III alloy is being examined. Variables include aging temperature and time, grain size, and applied stress. Stress-aging experiments will be extended to alpha-beta titanium alloys such as Ti 6- 4 and Ti 6-2-4-6 to determine the parameters that control phase transformation induced texture.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0002, DEVELOPMENT OF BINDERS FOR EXPLOSIVES AND PROPELLANTS

D.L. ROSS, Stanford Research Institute, *Menlo Park, California* 94025 (DN491002; N00024-75-C-5007)

Develop binders for explosives and propellants such that they can be readily decomposed and separated into their constituents for reuse.

Synthesize polymers whose cross links are stable at service conditions but are broken by elevated temperature, thus forming a polymer having less resistance to physical or chemical processing.

ADDENDA: Supporting agency address is: Naval Sea Systems Command, Washington, D.C. 20362

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0003, CORRELATION OF MICROSTRUCTURE WITH FRACTURE TOUGHNESS PROPERTIES IN TITANIUM ALLOYS

F.A. CROSSLEY, Lockheed Missiles & Space Co., *Palo Alto, California* 94304 (DN590051; N00019-75-C-0378)

To establish a basis for predicting fracture toughness of metals by correlating microstructure with fracture toughness.

Four conditions of Ti6Al-4V were studied, i.e., alpha segregation, and three processing defects - Ti3Al, oxygen and hydrogen contamination. Three basic types of microstructures for Ti6Al-6V-2Sn will also be studied.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0004, DEVELOPMENT OF DIRECTIONALLY SOLIDIFIED EUTECTIC NICKEL AND ALLOYS

F. LEMKEY, United Aircraft Corporation, *Hartford, Connecticut* 06118 (DN590014; N62269-76-C-0107)

To develop directionally solidified eutectic nickel alloys for service at 2000 degrees F and above.

Investigation is being made of ductile gamma prime/gamma plus alpha alloys. Factors influencing strength, ductility, oxidation-sulfidation resistance will be evaluated. Alloying additions will be studied, including Si, C, Te, Zr, Co, and W.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D.C. 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0005, ELECTROCHEMISTRY OF HYDRAZINE-HYDRAZINE AZIDE MIXTURES

C.T. BROWN, United Technologies Corp., *Hartford, Connecticut* 06108 (DF034300; F44620-72-C-0049)

Air Force operations and communications depend on primary and auxiliary power sources. New and improved electrochemical power sources, such as batteries and fuel cells, which are more reliable, lighter- weight, and higher-power, are needed. This research is concerned with the evaluation of the electrochemical parameters of a hydrazine- hydrazine azide electrolyte. This has application to high-energy density fuel cells and improved electrochemical power sources. Experiments are designed to characterize the anodic process by evaluating solutes, such as sodium azide, for analysis of the effect of the hydrazonium ion concentration on the anodic process. Special cells for use of gas analysis experiments are to be developed to measure the faradic efficiency of nitrogen evolution. Solvents similar to hydrazine such as monomethyl hydrazine (MMH) and unsymmetrical dimethyl hydrazine (UDMH) have been shown to have much lower electrical conductivity than purified hydrazine. A study will be directed to study these two nonaqueous solvents for possible use with hydrazine azide. The solubility of hydrazine salts in those systems will be studied as well as impurity levels and polarization characteristics.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NC, Bldg 410, Boliing AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0006, MATERIAL SUPPORT TECHNOLOGY - HIGH-PRESSURE LIQUID PROPERTIES RELEVANT TO LUBRICANTS AND EXPLOSIVES

C.J. MONTROSE, Catholic University of America, School of Arts & Sciences, *Washington, District of Columbia* 20017 (DN475468; N00014-75-C-0856)

A theoretical understanding is sought of the time-dependent changes in properties of liquids subjected to high (150,000 psi) pressures. Of concern are the non-linear property changes during non-equilibrium conditions. Such phenomena are applicable to the behavior of lubricants under conditions of high cyclic loading and to the shock sensitivity of liquid propellants.

Fluid property changes are experimentally induced by temperature changes. Relaxation times associated with various property changes, including specific heat, refractive index, and volume will be determined. A theoretical model will be formulated on the basis of these and subsequent experiments.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0007, HYDROCARBON LOW-TEMPERATURE VISCOSITY

C.T. MOYNIHAN, Catholic University of America, School of Engin. & Arch., *Washington, District of Columbia* 20017 (DN590097; N00019-76-C-0166)

One problem with some new candidate air-breathing missile fuels of the high-energy density hydrocarbon type is the high viscosity characteristic in the low-temperature end of specification requirements. This program will study the relationship between molecular structure of such hydrocarbons and their freezing point and viscosity behavior.

Phase diagrams will be obtained for isomer components of the type derived from norbornadiene. Thermodynamic and viscosity data will be obtained and correlated for the dimers.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D.C. 32061

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0008, NAVY ENVIRONMENT - THE ROLE OF PASSIVE SURFACE FILMS IN STRESS CORROSION SUSCEPTIBILITY

J. KRUCER, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20324 (DN923196)

This research aims to clarify some of the mechanisms by which metals of interest to the Navy, such as steels, corrode or fail due to stress corrosion so that measures may be taken to prevent these harmful reactions.

The role of passive surface films in the corrosion and stress corrosion susceptibility of steel, aluminum, and titanium alloys in various liquid environments is to be determined. Using electrochemical and ellipsometric techniques, the rate at which a ruptured passive film on these materials reforms and the rate of dissolution of the base metal during the reformation process is being measured. A correlation between corrosion and stress corrosion susceptibility and repassivation behavior is being sought in order to further identify degradation mechanisms.

ADDENDA: Supporting agency address is: Office of Naval Research 471, Arlington, VA. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0009, BASIC CHEMICAL AND PHYSICAL PROPERTY EVALUATION, HAZARD ANALYSIS AND HANDLING OF SYNTHETIC JP-5 FUEL

H.W. CARHART, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN580087)

To determine the basic chemical, physical and flammability properties of jet fuels derived from oil shale, tar sands, and coal. To define composition/property relationships of alternate fuels and to examine ways to modify unsatisfactory properties by compositional change. To determine the effectiveness of standard fire-fighting techniques with synthetic fuel and to develop additional methods and procedures as needed.

NRL is performing a comprehensive chemical, physical and flammability program to evaluate the characteristics of jet fuels derived from shale oil, tar sands and coal. The NRL work will emphasize non-specification tests, composition/property relationships, and chemical analyses. Fire-suppression techniques for substitute JP-5 will be evaluated in tests up to volumes of 300 gallons of fuel.

ADDENDA: Supporting agency address is: Naval Air Propulsion Test Center (PE-71), Trenton, N.J. 08628

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0010, NONDESTRUCTIVE TESTING OF HIGH-STRENGTH MATERIALS

S.D. HART, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN619170)

The objective of this program is to refine the techniques for ultrasonic inspection of naval structures, in particular thick section welds in titanium and other high-strength materials. Detection, location and correct evaluation are all important to increase reliability and reduce maintenance costs.

Emphasis will be directed toward ultrasonic techniques for defect characterization. Efforts will be directed toward development of imaging capability for flaw evaluation through ultrasonic holography and other techniques involving transducer arrays and computerized signal processing. This increased sophistication will require more precise knowledge of transducer characteristics. Procedures for transducer evaluation will be developed, and Navy-wide specifications for acquisition will be written. Instruments previously developed in this program will be used to verify ultrasonic equipment performance.

ADDENDA: Supporting agency address is: Naval Sea Systems Command (03522), Washington, D.C. 20362

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0011, ADVANCED HYDROCARBON FUEL DEVELOPMENT

R.N. HAZLETT, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN639147)

To give a chemical rationale to the complex oxidative and pyrolytic degradation reactions of jet aircraft fuels which give undesirable products such as varnishes and gums in fuel system components. Developments arising from these efforts will aid in defining jet fuel composition and suggesting alternate fuel-handling procedures and materials for fuel system components.

The chemical reactions of hydrocarbon components of jet aircraft fuels are being studied in a flowing system which simulates the heat stress in an advanced aircraft fuel system. The main effort is for exposures associated with short times (seconds), high temperatures (500- 1000 degrees F), and limited oxygen availability. The overall chemical reaction schemes are being examined so that the critical oxidative and pyrolytic reactions can be identified and altered.

ADDENDA: Supporting agency address is: Naval Air Propulsion Test Center (PE-71), Trenton, N.J. 08628

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0012, ELECTROTRANSPORT IN THIN FILMS

R.E. HUMMEL, State University of Fla. Sys., School of Engineering, *Gainesville, Florida* 32611 (DF042830; AF-AFOSR-2963-76)

AF function - microwave solid-state electronic devices are essential components of Air Force surveillance, electronic countermeasures and communications systems. Deficiency or opportunity - the occurrence of metal migration effects at elevated temperatures for various contact metal systems causes failure of these solid-state devices and thus reduces the reliability of systems employing these devices. Objective - the objective of this research is to examine the electrotransport properties of one-component and dilute alloy thin metal films. How work contributes - an understanding of the electrotransport mechanism and the factors which promote or retard this process will allow for further improvement in metalization for microwave solid-state devices. In particular, the role played by metallic underlayers in the electrotransport of various metals appears to be quite significant.

Various techniques will be used to measure the activation energies for electrotransport in thin films (on the order of 3000 angstroms) of copper, magnesium, tin, palladium and platinum. The role of the grain boundary network in electrotransport will be investigated by preparing a variety of aluminum and gold thin films. Annealed and unannealed samples will be compared. In addition, an attempt will be made to measure the Hall effect in thin films of gold in order to identify the primary charge carrier in the electrotransport process. Electrotransport in two-metal systems will also be investigated. Thin layers of gold will be deposited on a variety of transition metal underlayers (such as chromium, molybdenum, tantalum). Annealed samples will be examined both before and after electrotransport by means of auger analysis and ion milling in order to determine the interpenetration of the two components. Homogeneous, two-component thin film alloys of aluminum will be prepared, either by co-deposition or two-layer deposition and diffusion anneal, and examined for their electrotransport properties. The advanced resistometric technique will be used to measure the activation energies. This technique will be supplemented by scanning and transmission electron microscopy, optical microscopy and radioactive tracer studies.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NE, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0013, DEFORMATION PROCESSES IN REFRACTORY METALS

R.E. REEDHILL, State University of Fla. Sys., Florida Eng. & Ind. Expt. Sta., *Gainesville, Florida* 32601 (E(40-1)-3262)

The mechanical properties of metals and alloys can be strongly influenced by phenomena other than simple slip. Among these perturbing phenomena are dynamic strain-aging, mechanical twinning, and dynamic recovery. The nature of these, and the magnitude of their effects on the stress-strain behavior of the metals titanium and niobium containing interstitial impurities, are being determined. Emphasis is now being placed on an attempt to find interrelations between dynamic strain-aging and slow strain-rate embrittlement. In transition metals, both types of phenomena

can be caused by interstitial elements such as hydrogen, oxygen, nitrogen and carbon when the latter are in solid solution. Specific attention is being paid to the niobium-oxygen system. Specimens of high purity niobium (5 ppm N and 5 ppm C) will be doped to about 1.2 at % of oxygen. Tensile tests will be carried out to fracture on these specimens between 400 and 1100 K at several strain rates. Fractographic, ductility, and stress-strain data from these tests will be correlated and analyzed. These tests will be complemented by static strain-aging tests in which the specimens are aged under stress. Particular attention will be paid to specimens aged at a constant stress equal in magnitude to the flow stress. Aging under these conditions approximates the conditions existing during dynamic strain-aging and slow strain-rate embrittlement. In these aging studies, the kinetics and energetics of the aging process (at the flow stress level) will be determined.

RESULTS TO DATE: A dual empirical analysis of the stress-strain curves of polycrystal-niobium of two purity levels has been conducted. Both indicate that niobium basically shows a two-stage behavior. The parameters n in Ludwik equation sigma equals sigma/ k epsilon n, and m in the equation epsilon equals epsilon/ plus c sigma m, are indicative of dynamic recovery, and behave differently in different temperature ranges. Below about 650 K, the higher purity niobium (10 ppm oxygen) apparently has a higher degree of dynamic recovery than a material with a higher oxygen content (150 ppm), whereas the converse is true above this temperature. An investigation of the aging phenomena in nickel containing carbon as the major interstitial impurity has shed some light on the processes that occur during aging in a face-centered cubic material. (Text Abridged)

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

3.0014, MATERIAL SUPPORT TECHNOLOGY - SOLID-STATE REACTIONS ON SEMICONDUCTORS

E.J. SCHEIBNER, Georgia Inst. of Technology, Engineering Experiment Station, *Atlanta, Georgia* 30332 (DN575362; N00014-75-C-0909)

The development of advanced, reliable devices and new device fabrication techniques for solid-state electronics devices will require increased knowledge and data about solid phase reactions. This research task will explore the chemical and physical reactions which occur at the solid-solid interfaces between various electronic materials.

Using the techniques of auger electron spectroscopy (AES) and x-ray photoemission spectroscopy (XPS), studies will be made of the chemical effects which occur at the interfaces of various solid materials. These materials will be processed at temperatures such that only solid phase reactions can occur. The chemical information is derived from 'chemical shift' information inherent to the auger and photoemission spectroscopies. Reaction kinetics will be analyzed and concentration profiling of the thin layered films will describe the solid phase processes which occur. The systems of prime concern are the metal-oxide interface on silicon (thermal oxide) and on gallium arsenide (anodic oxide) and the metal-semiconductor interface on the same semiconductors. MOS and Schottky barrier test structures will be fabricated and the chemical results correlated with electrical measurements.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0015, NAVY VEHICLE DESIGN AND CONSTRUCTION - MEASUREMENT OF RESIDUAL STRESSES

J.B. COHEN, Northwestern University, School of Technology, *Evanston, Illinois* 60201 (DN923045; N00014-75-C-0580)

The service life of critical naval components such as gears, bearings, and helicopter blades depends, in part, on the surface residual stresses developed by heat treatment and fabrication. For best fatigue life it is important to measure and control these stresses. This research will develop needed information on microstructural factors which influence the measurement of residual stresses and on the properties of the plastic zone ahead of fatigue cracks.

An automated system for measuring residual stresses by x-rays will be developed. A position-sensitive detector will be employed which will permit recording of the entire x-ray diffraction peak without moving the detector. In a parallel study the elastic and plastic zones ahead of a fatigue crack in 4340 steel will be analyzed using a microbeam x-ray technique. Information on residual stresses and structural changes associated with the fatigue crack front will result.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0016, FRACTURING CHARACTERISTICS OF ADHESIVE JOINTS

S. MOSTOVOY, Materials Research Lab. Inc., *Glenwood, Illinois* 60425 (DN590118; N00019-76-C-0323)

To identify and quantify fabrication, environment and use variables controlling fracture of adhesively bonded structures so stronger and more reliable aircraft and missile structures can be made.

Fracture mechanics techniques are being applied to bonded structures. Variables being investigated included adherent surface preparation, adhesive composition and post cure cycle, bond thickness, load rate, tmperature, crack velocity, humidity, etc.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0017, PITTING IN ALUMINUM - 12821-MS

M. METZGER, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801 (DA0R5575; DAAG29 76 G0039)

To study the origins of film breakdown and mechanisms of pit initiation in aluminum and its dilute alloys the evaluators at MERDC, CERL, AMMRC, FA, and EA cite relevance to the mission areas of missiles, aricraft, armament, and armor, where pitting damage of aluminum alloys occurs in both aqueous and non-aqueous media, often leading to functional failures of such equipment.

1. Study film growth and breakdown and other electrochemical parameters pertinent to the mechanisms of pit initiation and growth, in order to formulate and evaluate models of these mechanisms. 2. Study the effect of addition of small concentrations of copper to pure aluminum to determine its effect on pitting mechanisms.

ADDENDA: Supporting agency address is: DARCOM Army Research Office, Box 12211, Research Triangle Park, NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

3.0018, DEVELOPMENT OF BERYLLIUM-TITANIUM COMPOSITE FAN BLADES FOR NAVAL AIRCRAFT ENGINES

M. HERMAN, General Motors Corporation, *Indianapolis, Indiana* 46206 (DN590036; N00019-75-C-0264)

Develop improved beryllium/titanium composite extrusions by optimizing process variables and obtain the design criteria for prototype fan and compressor blades.

Develop and evaluate a process to integrally forge a root attachment on the end of extruding beryllium/titanium composite blade forgings.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0019, TRANSPORT AND THERMODYNAMIC PROPERTIES OF SOLIDS

R.E. GRACE, Purdue University, School of Materials Engin., *Lafayette, Indiana* 47907 (E(11-1)-1436)

OBJECTIVE: The objective of the program is to investigate atomic diffusion, interfacial stability and development of diffusion structure in solid multi-component, multiphase alloys and intermetallic systems. Intrinsic and interdiffusion coefficients are evaluated with diffusion couples in the following ternary systems: Fe-Ni-Al and Cu-Zn-Ni. The diffusion couples are analyzed by electron microprobe analysis and scanning electron microscopy. The development of nonplanar interfaces between diffusion

layers is explored in terms of nonequilibrium compositions and the related discontinuities or rises in the profiles of thermodynamic activities of the diffusing components observed in the vicinity of perturbed interfaces.

RESULTS TO DATE: Multiphase diffusion has been investigated in Fe- Ni-Al system at 1000 degrees C with Beta(bcc) and Gamma(fcc) alloys, and the development of instabilities at the Beta/Gamma interface in the profiles of thermodynamic activities of the diffusing components. Time evolution of diffusion paths has also been determined in selected couples. Data on interdiffusion coefficients also have been determined in both Beta and Gamma phase regions of the Fe-Ni-Al isotherm at 1000 degrees C.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

3.0020, WEAPONRY - RESEARCH SUPPORTING JET PROPULSION TECHNOLOGY (PROJECT SQUID)
S.N. MURTHY, Purdue University, Purdue Research Foundation, *Lafayette, Indiana* 47907 (DN524574; N00014-75-C-1143)

In the project 'Principles of Chemical Propulsion and Armaments,' this task is a major effort in support of jet propulsion technology, generating understanding and expansion of knowledge required for the development of jet devices used in naval aircraft missiles and space vehicles. The objectives of squid are: (1) stimulate interests of scientists and engineers in solving Navy-related problems, (2) plan and support basic and applied research relating to jet propulsion, and (3) provide capability for conducting special studies, consulting, and probing new avenues of relevant research.

Project SQUID headquarters office, upon approval of the power program, conducts a subcontracting program on physical and chemical processes of energy transformation in relevant scientific areas pertinent to jet propulsion.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0021, INVESTIGATION OF MULTIDIRECTIONAL FIBER-REINFORCED COMPOSITE FOR IMPROVED IMPACT RESISTANCE
J.W. HERRICK, Fiber Materials Incorporated, *Biddeford, Maine* 04005 (DN590149; N00019-76-C-0411)

To investigate the resistance of multi-directional composite materials to small and large particle impact.

Investigate woven multi-directional, (three-dimensional) reinforced composite materials with varying degrees of orientation and types of reinforcements. This will cover applications for electromagnetic windows and aircraft structures where small particles are impacted at airstream velocity and large particles impacted at lower speeds.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0022, NAVY ENVIRONMENT - STUDIES OF DELAYED FRACTURE MECHANISMS IN ALUMINUM ALLOYS USED IN NAVAL AIRCRAFT AND BOAT STRUCTURES
J.A. GREEN, Martin Marietta Corporation, *Baltimore, Maryland* 21227 (DN723866; N00014-74-C-0277)

The investigators seek to determine the causes and mechanisms responsible for delayed failure in many strength aluminum alloys used in naval structures when stressed in the marine environment.

The effect of microstructural variations on the delayed fracture behavior of Al-Zn-Mg alloys is being studied. Variations of microstructure are achieved by heat treatment and are characterized by optical and electron microscopy and by electron and x-ray diffraction techniques. Specimens are subjected to a constant tensile stress in aqueous chloride solution and time to failure and fracture patterns are correlated with microstructure. A description of the mechanisms of delayed fracture in terms of microstructure, defect structure, stress and environmental dissolution of material is sought.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0023, STRENGTHENING MECHANISMS IN NICKEL-BASE SUPERALLOYS
R.D. FRENCH, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0E4798)

To investigate mechanism for strengthening and improving creep resistance in superalloys. Emphasis will be given to the role of carbides in changing strength and ductility. In prior years, the morphology of mc carbides in nickel base alloys has been examined to determine the extent of connectivity and to relate morphological developments to specific thermal treatments. It has been shown that changes in strength and ductility accompany these morphological changes. This project supports problem areas 14.1 and 15.1 of the Materials Technology Plan for Aircraft, guidance for FY75. In addition, this project directly supports the analyses of fracture in nickel superalloys.

This project will examine the role of secondary phases in strengthening nickel base superalloys. Attention will be directed at those phases which have a primary role in high-temperature strengthening, although first efforts will be directed at determining the effects of those phases on room-temperature strength and ductility. Specimens will be subjected to appropriate thermal treatments to alter the minor phases.

ADDENDA: Supporting agency address is: DARCOM Materials & Mechanics Research Center, Watertown, MA 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0024, VISCOELASTIC CHARACTERIZATION OF FILAMENTARY COMPOSITES
E.M. LENOE, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0D4750)

To provide the necessary data to effectively assess filamentary composites over the appropriate temperature range for use in aircraft and missile structures. Specific objectives include determining the anisotropic viscoelastic functions and characterizing the mechanical response of composite materials of importance in Army materiel.

Viscoelastic characterization of boron aluminum and a selected graphite epoxy will be completed. Preliminary evaluation of time- dependent behavior of kevlar and of the 3m glass epoxy used in AMMRC environmental deterioration studies will be undertaken. Laminate theories appropriate for the composite materials which have been studied during this project will be suggested. Future efforts under another work unit will be devoted to the failure behavior of hybrid composites under combined stress and complex loading paths. The linear viscoelastic characterization studies will be terminated.

ADDENDA: Supporting agency address is: DARCOM Materials & Mechanics Research Center, Watertown, MA 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0025, FATIGUE FRACTURE OF COMPOSITE MATERIALS
J. SLEPETZ, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0C4687)

This effort addresses the program thrust G-2 'Survivability of Aircraft and Combat Vehicles' and Aircraft Pacing Problem No. 10 'Design Criteria for Fatigue and Fracture of Fiber-Reinforced Composites, Structural Sandwich Composites, and Advanced Metallics.' To develop rational bases for predicting failure in fiber-reinforced composites subjected to static and fatigue loads, to determine fail-safe crack arrest capability of stiffened composite panels, and to establish design guidelines for laminated composites under static and fatigue load conditions. Use of composites in major aircraft systems such as HLH, UTTAS, and AAH requires adequate knowledge and predictability of structural performance of these materials.

Fracture toughness experiments on S-glass/epoxy and graphite/epoxy compact tension specimens are being carried out. Fracture tests and stress concentration experiments have been

made on unidirectional and laminated composite specimens to simulate conditions in structural panels with geometric or battle damage discontinuities. Crack arrest studies are being carried out on stiffened composite panels.

ADDENDA: Supporting agency address is: DARCOM Materials Mechanics Research Center, Watertown, MA 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0026, PLUME DYNAMICS OF SMOKELESS SOLID PROPELLANTS 13655-A-GS

E.L. MILLER, Univ. of Nevada System, Agric. Experiment Station, *Reno, Nevada* 89507 (DA0X5575; DAAG29 76 G0089)

To predict conditions for maximum and minimum smoke dispersion rates of plumes from rocket and guided missile systems. Research supports an Army smoke measurement program now underway and should contribute to the formulation of smokeless propellants for future Army use.

(1) A computer program modeling the growth of seeded and nonseeded droplets will be developed in order that the size and number of droplets in the plume can be predicted. (2) The above program will be run using propellant formulations of interest to MICOM. Calculations with test data from the MICOM smoke tunnel will be incorporated in the model.

ADDENDA: Supporting agency address is: DARCOM Army Research Office, Box 12211, Research Triangle Park, NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

3.0027, INTERACTIONS OF DEFECTS IN HIGH CONCENTRATIONS IN SOLID OXIDE ELECTROLYTES

A.S. NOWICK, Columbia University, School of Engineering, *New York, New York* 10027 (DMR76-80157)

The application of oxides of the fluorite structure, particularly to fuel cells, is limited by two factors: defect interactions and polarization effects. It is the purpose of this work to understand defect interactions and thereby to optimize the selection of compositions and conditions under which these materials can be utilized. Recent work at Columbia University has shown that suitably doped CeO2 may be very promising solid oxide electrolyte, and is an ideal choice for the study of defect interaction effects.

The present investigation continues to address the question of the nature of the defects present and their interactions in CeO2 doped with various divalent (M2 ion) and trivalent (M3 ion) cations. A variety of techniques which give related, but different, information are utilized. Among these are ionic conductivity, dielectric and anelastic relaxation, as well as neutron diffraction and diffuse scattering. It is already apparent that M2 ion dopants and M3 ion dopants give rise to very different defects. Studies are being made to understand these differences as well as changes which occur as a function of dopant concentration and ionic radius.

This is a continuation of research supported under DMR74-23877.

SUPPORTED BY U.S. Natl. Science Foundation

3.0028, NAVY VEHICLE DESIGN AND CONSTRUCTION - INVESTIGATION OF ALLOY SEGREGATION IN ALUMINUM ALLOYS USED FOR NAVAL AIRCRAFT

G. JUDD, Rensselaer Polytechnic Inst., School of Engineering, *Troy, New York* 12181 (DN923248; N00014-75-C-0504)

In many aluminum alloys used in naval aircraft, segregation of alloying elements can occur during the heat treatments used to develop high strength levels. Such segregation can lead to problems such as low ductility or stress corrosion cracking under certain stress and environmental conditions. The objective of this research is to study segregation in various aluminum alloys in order to determine methods of controlling it and to eliminate its harmful features.

Alloy segregation in aluminum alloys based on the Al-Mg-Zn system is to be studied by means of electron microprobe analysis. Substructural features are to be assessed by means of transmission electron microscopy. Aging characteristics, segregation and structure resulting from various heat treatments and additions of trace elements will be determined. The relationship between structure, mechanical properties and stress corrosion resistance will be made using current mechanical testing methods.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0029, QUANTUM STUDY OF SELECTED ATOMIC-DIATOMIC MOLECULE REACTIONS INVOLVING HYDROGEN, OXYGEN, AND NITROGEN (ABBREV)

G. WOLKEN, Battelle Memorial Institute, *Columbus, Ohio* 43201 (DA0E9168; DAAG29 76 C 0048)

To develop accurate quantum mechanical methods for treating chemical reactions and to apply them to reactions involving atomic hydrogen, oxygen and nitrogen. Results will enhance our understanding of the dynamics of flames, explosions, and highly non-uniform chemical processes.

Fully quantum mechanical calculations of reaction cross sections and state-to-state transition probabilities for a variety of reactions will be performed using the natural collison coordinate method.

ADDENDA: Supporting agency address is: DARCOM Army Research Office, Box 12211, Research Triangle Park, NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

3.0030, MATERIAL SUPPORT TECHNOLOGY - METALLIC GRAPHITE INTERCALATED COMPOUNDS

J.E. FISCHER, Univ. of Pennsylvania, School of Engin. & Appl. Sci., *Philadelphia, Pennsylvania* 19104 (DN575151; N00014-75-C-0751)

Development of intercalated graphite metallic fibers for use in high-strength composite wires offers applications in naval systems which feature room-temperature conductivities equal to or better than copper and are lighter, stronger, and cheaper than a comparable copper wire. The objective of this program is to determine the electronic structure of these compounds in order to correlate the electrical behavior with their atomic structure and composition, with a view to being able to design better conductors.

Metallic graphite intercalation compounds will be studied in the dilute limit and in the concentrated limit in order to follow the change in electronic structure between these limits. Experiments will focus on Fermiology and optical properties. Studies of magnetic susceptibility and magnetoresistance will be used to ascertain the effect of the intercalate on the Fermi surface and on transport parameters. The optical studies will rely heavily upon thermoreflectance spectroscopy.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0031, NAVY VEHICLE DESIGN AND CONSTRUCTION - SOLIDIFICATION OF METAL ALLOYS

H.D. BRODY, Univ. of Pittsburgh, School of Engin. & Appl. Sci., *Pittsburgh, Pennsylvania* 15260 (DN823163; N00014-75-C-0800)

Many naval components are used in the cast microstructure form. Mechanical properties of castings and in situ eutectic composites are directly related to the cast structure and any alloy segregation that occurs during solidification. This research is aimed at improving properties of castings through improved control of the process variables.

Several facets of solidification are under investigation here. The structure-property relationship in Nb-C system is being examined to determine the cause and effect of rod versus plate structures. The continuous casting process for aluminum is being modeled by computer techniques to determine the role of important process variables. A review of titanium casting will be made to determine the solidification- related problems facing titanium processors and to suggest possible solutions.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0032, ANTIWEAR ADDITIVES - NOVEL APPROACHES TO SYNTHESIS AND MECHANISTIC CONSIDERATIONS
H. LEE, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN581138)

Initiate a systematized research effort to (a) establish correlations between chemical structure and performance for new heat stable antiwear lubricant additives, (b) gain new modern insights into the mechanisms of antiwear additive protection and (c) synthesize new heat-stable antiwear lubricant additives. A complete understanding of the chemical aspects associated with antiwear additive synthesis and functionality will provide direction information for the development of new and improved high-temperature military aircraft fluids and greases.

An extensive literature survey would be made to learn the relationships which exist between the chemistry and the performance of antiwear lubricant additives; and to learn what new classes of compounds have recently been proposed for this purpose. Various fluids incorporating antiwear additives will be analytically investigated under controlled experimental conditions in order to establish lubricating performance properties. Differences in performance characteristics will be related to bearing composition and geometry as well as chemical structure of both the base fluid and antiwear additive. In addition, chemical thermodynamics and kinetics will be used to effectively predict lubricating performance and thereby guide the application and use of these materials.

ADDENDA: Supporting agency address is: Naval Air Development Center, Warminster, Pennsylvania 18974

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0033, ENERGY CONVERSION - CHEMILUMINESCENT LIGHT SOURCES
L.M. ADAMS, Southwest Research Institute, *San Antonio, Texas* 78228 (DN575283; N00014-75-C-0997)

Chemiluminescence, or the production of light by chemical reactions, is of interest to the Navy for a variety of uses including the marking areas in aircraft recovery operations. It is proposed to study new, high-efficiency chemiluminescent systems recently formulated at the Naval Weapons Center and to investigate materials for encapsulation of those materials.

Systems containing substituted aryl oxalates, which are oxidized by hydrogen peroxide to produce chemiluminescence, will be studied and encapsulated in small, thin-walled spheres. When broken, the contents of the spheres will react to produce light.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0034, TRANSIENT HIGH-PRESSURE LIQUID RHEOLOGY
A. CAMERON, Framan Distributors Limited, *Watford, England, United Kingdom* (DN575193; N00014-75-C-0388)

The objective of this work is to determine the influence of molecular structure on the time-dependent viscosity and density response of liquids and other viscoelastic materials. This data is needed in the design and development of rolling element bearing and gears for high load-high speed applications in equipment such as gas turbine and helicopter transmissions.

The approach will be to measure the densities and viscosities of the subject lubricants as a function of time at pressures up to 500,000 psi using a newly developed micro high pressure optical viscometer and to correlate these properties with theories of solid and liquid material rheology.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, ANALOG-DIGITAL CONVERSION TECHNIQUES
P.R. GRAY, Univ. of California, School of Engineering, *Berkeley, California* 94720 (ENG73-04184 A01)

This research program is directed towards optimum techniques for analog-to-digital and digital-to-analog conversion systems using metal- oxide-semiconductor (MOS) technology. Previous work emphasized techniques for analog-to-digital conversion. The current effort includes the following areas of investigation: (1) Input buffer amplifiers and scaler/attenuator; (2) Voltage reference circuits; (3) Techniques for non-uniform quantization; (4) Digital-to-analog converters.

Potential applications are found in industrial process control, environmental monitoring and control systems, health care delivery systems, automotive pollution control systems, utility metering systems, aircraft and spacecraft control systems, and voice and picture communication systems.

SUPPORTED BY U.S. Natl. Science Foundation

4.0002, CONICAL PHASED ARRAY ANTENNAS
W.H. KUMMER, Hughes Aircraft Company, *Culver City, California* 90230 (DN590167; N00019-76-C-0495)

The results of prior theoretical and experimental efforts will be used to design, fabricate and test an experimental conformal phased antenna array on a conducting conical surface.

It is proposed to integrate the technique of the geometrical theory of diffraction with the tip-diffraction coefficient analysis and the model analysis for the purpose of designing a conical array. These analyses will be used with the equivalence-principle pattern synthesis technique to design a conical array with specified patterns. This design will include selection of appropriate radiating elements and determination of their impedance characteristics.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D.C. 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0003, PILOT'S VERTICAL FLIGHT DIRECTOR DISPLAY DEVELOPMENT
G. WOLFSON, Hughes Aircraft Company, *Culver City, California* 90230 (DN781221; N62269-76-C-0233)

To develop a pilot's highly reliable advanced television type vertical display for naval aircraft of the 1975-1980 era. The goal is to develop a display system that will provide a 1000 hour MTBF. This contract supports work unit ZA101, Agency Accession No. DN681080.

The contractor will develop, fabricate, test and deliver peripheral hardware equipment that will enable NavAirDevCen personnel to operate the Navy's programmable symbol generator and interface it with the NavAirDevCen AIMIS display system.

ADDENDA: Supporting agency address is: NADC, Air Vehicle Technology Dept., Warminster, PA

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0004, INTERACTIVE COMPUTER-AIDED COMPOSITE JOINT DESIGN
M.K. SMITH, McDonnell Douglas Corporation, *Long Beach, California* 90808 (DF136140; F33615-76-C-3058)

Working in an interactive mode with digital computers has been shown to drastically reduce elapsed time for iterative type solutions and reduce human errors. The design of composite joints is normally an interactive problem, where it is necessary to review geometrics, materials, and internal load and stresses of candidate designs to optimize design details. The objective of this program is to improve the design capability for joints and stress concentrations in composite aircraft structures by exploiting the interactive communication with digital computers. The most critical design problem in composite aircraft structures is that of the stress concentrations at joints and cutouts.

An in-depth investigation will be made of the use of interactive computer operation and computer graphics to facilitate the design of composite structures at stress concentrations. Double-lap, single-lap, scarf and stepped-lap bonded and bolted joints will be considered.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FBR, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0005, LOW-POWER, HIGH-DATA-RATE MODULATOR

M.K. BARNOSKI, Hughes Aircraft Company, *Malibu, California* 90265 (DF099840; F33615-75-C-1028)

Develop a modulator utilizing the E-O effect in an optical waveguide which has a high optical transmission, requires drive voltages on the order of ten volts, provides 100 percent modulation, has a rise time of .2 nanoseconds, has a capability of handling average powers of 1/2 watt for a mode locked laser at ND or doubled ND wavelengths, and a power figure of merit of less than three mw/mHz. The data rate will be in the gigabit range.

Using the techniques of integrated optics, the optical beam which is to be modulated is coupled into a thin film waveguide fabricated in a good E-O material (e.g., ZNO epitaxially grown of Al2O3 or diffused guides in LiTaO3). Surface electrodes produce an index change in the waveguide through the E-O effect. Periodic electrodes produce a periodic index change which deflects the laser beam. The laser beam is thus switched between two angular directions and modulation is observed by viewing either beam.

ADDENDA: Supporting agency address is: AF Avionics Laboratory DHO, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0006, ADAPTIVE ANTENNA ARRAYS FOR AIRCRAFT COMMUNICATIONS

B. WIDROW, Stanford University, School of Engineering, *Palo Alto, California* 94305 (DN590111; N00019-76-C-0250)

To investigate adaptive antenna algorithms appropriate for use in airborne multiple access communication systems.

Emphasis will be placed on a study of transient and steady-state performance of adaptive processors with stochastic and deterministic inputs. A relationship between rate of convergence and steady-state noise in the adaptive processor weights will be developed. Performance comparisons will be made between linear random search algorithms and the least means square algorithms.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0007, MEASUREMENTS IN LARGE-SCALE TURBULENT MIXING LAYERS FOR SYSTEMS OF NAVAL INTEREST

A. ROSHKO, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (DN623976; N00014-76-C-0260)

Since the flows over all naval ships and airplanes are largely turbulent, measurements, which lead to a better understanding of such flows, could result in significant improvements in the performance of naval craft. This experimental task will obtain data to develop phenomenological laws to predict the effects of density differences and pressure gradient on the turbulent processes so that reliable engineering estimates are available for design.

Experimental investigations of turbulent mixing and coherent- structure properties and interactions in turbulent shear flows will be continued. Specifically, work will proceed on the following problems: (1) laser-Doppler velocimeter measurements in a large-scale turbulent mixing layer in the free surface water tunnel; (2) complementary studies in the gas-mixing facility using shadow-graph movies; and (3) measurements in a two-density wake.

ADDENDA: Supporting agency address is: Office of Naval Research 438, Arlington, VA. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0008, SPECTRAL ENERGY TRANSFER AND COHERENT STRUCTURES IN LABORATORY AND GEOPHYSICAL TURBULENT FLOWS

C.W. VANATTA, Univ. of California, Scripps Inst. of Oceanography, *San Diego, California* 92038 (ENG76-13147)

Support shall be provided to continue laboratory and field experiments to investigate the mechanism of spectral energy transfer and the effects of coherent structures and intermittency on turbulent shear flows. The principal objective of this spectral transfer work will be to develop and test Fourier decomposition techniques that can be successfully extended to measurements in high Reynolds number laboratory flows and the atmospheric boundary layer in order to examine the detailed transfer of kinetic energy and scalar fluctuations between different scales of motion. Calculations will be carried out on existing laboratory data to resolve questions concerning statistical resolvability, convergence, and the degree of isotropy for heated wake and jet. The principal objective of the work on coherent structure is to develop and apply objective criteria techniques for isolating the effects on measured statistical properties of relatively well-organized flow structures embedded in turbulent flows.

SUPPORTED BY U.S. Natl. Science Foundation

4.0009, EXPERIMENTAL STUDIES ON LASER BEAMS

G.R. OCHS, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8AA7 13 10)

OBJECTIVE: Experimental studies of the use of visible and infrared light beams for remotely sensing atmospheric parameters, particularly wind and turbulence.

CURRENT YEAR PLAN: Effort will be made to demonstrate the optical wind sensor to prospective users in various applications, and to improve the present optical devices to measure the wind in more detail and, through the use of infrared, to make them more immune to interfering background lights and to sunlight.

PROGRESS: An improved 'saturation-resistant' wind sensor has been built and tested. Three of the saturation-resistant units have been combined in a divergence triangle and used for a pre-Sesame test at Kimball, Nebraska.

SUPPORTED BY U.S. Dept. of Commerce - N.O.A.A.

4.0010, STUDIES WITH MOLECULAR BEAMS FROM SUPERSONIC FREE JET SOURCES

J.B. FENN, Yale University, School of Engineering, *New Haven, Connecticut* 06520 (ENG75-21821 A01)

The research covers studies of: (1) Beams of macromolecules obtained by electrospray atomization of solutions into a carrier gas, subsequent evaporation of solvent to provide a gaseous dispersion of macroions, and expansion of this dispersion in a free jet to form a molecular beam. The immediate problem is to find a more sensitive detection system for the macroions. (2) The polymerization reactions which occur in the supersaturated regions of freely expanding jets. A particular objective is to calibrate the mass spectrometer for dimers and other lower polymers so that meaningful observations can be made on the polymerization kinetics. (3) The scattering of molecular beams by clean liquid surfaces with emphasis on the energy dependence of the distribution of reflected flux and the effect of incident molecules on the evaporation of the liquid substrate. (4) Molecule surface interactions to permit the use of gas chromatography for detection and study of isomerization reactions which provides an increase in detectability of 10 to the fourth power. (5) The effect on reaction probability of laser excitation of particular vibrational modes in beam molecules prior to their incidence upon a surface.

This research is the second year of NSF Grant No. ENG-7521821.

SUPPORTED BY U.S. Natl. Science Foundation

4.0011, ELECTROMAGNETIC VULNERABILITY TO LIGHTNING ACTIVITY

R.V. ANDERSON, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN680120)

Develop instrumentation to measure magnetic fields produced by lightning strokes, define the electromagnetic environment produced by lightning, and deduce criteria for appropriate circuit hardening.

Airborne electronics has become increasingly vulnerable to damage and/or malfunction produced by the effect of natural lightning discharge. As systems are reduced in size and power level, the energy needed to produce such effects is materially reduced. The large values of DL/DT characteristic of lightning strokes produce magnetic fields which, in turn, can induce potentially damaging energy levels into shielded equipments, even those without external lead wire connections. Hardening of systems to such damage requires a knowledge of the fields which will be encountered. Instrumentation will be developed to measure the three-axis magnetic field which is sufficiently small and portable to be emplaced at many points within an aircraft. Measurements will be made with this instrument in aircraft exposed first to artificially simulated lightning strokes and, subsequently, to natural lightning.

ADDENDA: Supporting agency address is: Naval Air Systems Command (AIR-360F), Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0012, TV PROJECTION SYSTEM

G.R. ROSENDAHL, U.S. Navy, Physical Sciences Laboratory, *Orlando, Florida* 32813 (DN494038)

To provide a TV projection system with very high light output capability (4,000 lm or more) together with high reliability and good adaptability to training device requirements (increased number of scan lines and an aspect ratio larger than the conventional one) for very wide-angle displays and high-resolution closed-circuit operation as required for the visual simulation in training devices.

Replace the conventional schlieren method by a differential interference method that is a two beam interference with the two beams displaced by half the scan line width in this case, in order to eliminate the contradictory requirements for resolution and sensitivity to which the schlieren method is subjudged, and to obtain better adaptability to non-conventional high number of scan lines and large aspect ratios, to obtain higher sensitivity (full modulation with less power in the electron beam) and higher light efficiency, to make 'raster shaping' in TV-projectors possible.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Instrumentation and Flight Controls, Washington, D.C. 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0013, UNSTEADY VISCOUS FLOW

J.C. WU, Georgia Inst. of Technology, School of Aerospace Engin., *Atlanta, Georgia* 30332 (DN575103; N00014-75-C-0249)

The prediction of the gust response, dynamic stability and flutter characteristics of aircraft and missiles requires an accurate knowledge of unsteady aerodynamic flows. Because of the complex nature of such flows when viscous effects are important, coupled with the limited availability of reliable measurements, serious shortcomings exist in existing predictive methods. The objective of this research is to use numerical solutions of the Navier-Stokes equations to assess the assumptions, approximations, and ranges of validity of existing inviscid theories for oscillating airfoils.

In this research an integro-differential formulation of the incompressible Navier-Stokes equations will be used to compute the complete history of the viscous flow field development about an airfoil undergoing sinusoidal oscillations in sufficient detail to permit the delineation of the various flow features, including the periodic shedding of vortices and the accompanying change of circulation, and the periodic variations of pressure, forces and moments. Calculations will be made for a range of frequencies appropriate to aircraft and missile flight. Corresponding inviscid calculations will be used for assessment purposes.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0014, TWO-PHASE FLOW

T.J. HANRATTY, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801 (ENG76-22969)

This research is concerned with obtaining a basic understanding of the interaction of a turbulent fluid with a liquid or solid boundary and with using this understanding to provide a better basis for analyzing and designing two-phase flow systems. It is a continuation of research previously supported by the Foundation (ENG71-02362 A04). The current specific objectives are (a) to develop a model for turbulent flow over a wavy surface and to use this model to obtain a better understanding of the influence of waves on mass transfer, surface resistance and wave phenomena of importance in annular gas-liquid flows; (b) to develop a model for turbulent mass transfer at a solid boundary and at a gas- liquid interface which is consistent with present knowledge about turbulent flow close to a boundary; (c) to obtain a better understanding of droplet exchange processes in annular two-phase flow; and (d) to devise a model for annular gas-liquid flow which will provide a basis for developing much-needed design relations for entrainment, mass transfer, and reaction rates.

SUPPORTED BY U.S. Natl. Science Foundation

4.0015, ADVANCED ELECTRONIC PACKAGING FOR AVIONICS

R.H. HUSS, U.S. Navy, Avionics Facility, *Indianapolis, Indiana* 46218 (DN697009)

To provide a modular packaging definition compatible with the system partitioning requirements of future high-density electronics in high-performance platforms. An adequate modular packaging definition will permit the further development of standard functional modular packaging in a manner which can achieve simultaneously reasonable goals in high density, high reliability, adequate performance, and low life cycle cost. Top down functional partitioning is a key element in arriving at an adequate packaging definition.

Trade-off criteria will be established for packaging and functionality requirements. Based on packaging studies including a determination of the requirements and constraints imposed by various avionics platforms, standard modules and higher level packaging systems (i.e., enclosures and racks) will be defined. This task complements the packaging work under Agency Accession Number DN687502 by placing additional efforts on specific packaging requirements for high- performance aircraft.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0016, EXPERIMENTAL STUDY OF WALL-TO-ADIABATIC WALL TEMPERATURE RATIO EFFECTS ON SMOOTH WALL BOUNDARY-LAYER TRANSITION IN SUPERSONIC FLIGHT

D.C. REDA, U.S. Navy, Flight Measurements Division, *Silver Spring, Maryland* 20910 (DN685097)

To experimentally determine the influence of wall-to-adiabatic wall temperature ratio on smooth wall boundary-layer transition in supersonic free flight.

Smooth, slender, sharp-tipped cones will be launched at supersonic velocities into well-defined, quiescent environments created within the NavSurfWpnCen's WOLS 300-foot pressurized ballistics range (PBR). Boundary-layer transition locations will be determined optically via high-speed shadowgraph photography. Wall-to-adiabatic wall temperature ratio will be varied over the range of approximately .1 to approximately .6 by electrically heating or cryogenically cooling the range air within a specially fabricated environmental test chamber, cone surface temperature will remain essentially constant over the short time duration of flight (TW approximately 540 degrees R). Launch velocity will be properly chosen for each free-stream temperature level to ensure a constant free-stream Mach number of 4.5 throughout the program. The stated temperature ratio regime will be covered at each of two edge unit Reynolds numbers, (u sub e/upsilon sub e) is approximately equal to 4 x 10(6)/ft and 10(7) ft, which will be maintained constant for each test by adjusting the range static pressure.

ADDENDA: Supporting agency address is: Naval Air Systems Command, AIR-320C, Washington, DC 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0017, DISTRIBUTED FEEDBACK LASER
R. PAYNE, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF900780)

AF function - communications technology. Deficiency or opportunity - problems of security, susceptibility to electromagnetic interference and inadequate signal bandwidth. Objective - to develop a new thin film signal source for use in integrated optical circuits. How research contributes - by addressing one of the major technological problems in integrated optics.

Approach involves fabrication of gallium arsenide thin film laser diodes with periodic gain and index of refraction variations. Periodic structure provides the resonant cavity required for laser oscillation without the need for the Fabry-Perot facets which cannot be fabricated in a dielectric waveguide. Problems to be addressed include epitaxial growth of thin films, characterization of diodes and fabrication of gratings using photolithography and ion implantation techniques.

ADDENDA: Supporting agency address is: Rome Air Development Center ETS, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0018, ELECTRON BEAM FABRICATION OF HARDENED DEVICES
S.A. ROOSILD, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF241820)

AF function - space and missile systems. Deficiency - solid-state circuits used in space and missile systems, develop prohibitively large photocurrents when exposed to pulsed gamma radiation. Research - study means of reducing the size of integrated circuits components to increase radiation resistance. How research contributes - the reduction of circuit and device size directly increases operating frequency, increases reliability, decreases power consumption and reduces pulsed radiation induced photocurrents.

Present methods used in the fabrication of solid-state devices are based on light optics and have been developed close to the theoretical limits of light optics. Further refinements of these systems can result only in a very small improvement; conversely, the application of electron optics will immediately allow area reductions of one order of magnitude over the best that is achieved to date and has the potential for far greater improvements.

ADDENDA: Supporting agency address is: AF Cambridge Research Laboratories LQ, L.G. Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0019, COMMUNICATIONS - SOLID-STATE ELECTRONIC COMPONENTS AND CONTROL-JSEP
N. BLOEMBERGEN, Harvard University, School of Engineering, *Cambridge, Massachusetts* 02138 (DN624307; N00014-75-C-0648)

To provide the Navy the technological basis for improved solid state and electromagnetic components and devices for communications, surveillance, navigation and information handling by taking advantage of vast expertise available at institutions of recognized standing such as this one under the joint services electronics program. The study of fundamental physical and electronic processes and properties leads to advancement in the technology of lasers and optical components, heat- sensitive detectors, accurate navigation schemes, missile and aircraft guidance and control, high-performance microelectronic circuitry having small size and weight and methods for handling efficiently large amounts of data.

The subject emphasis at Harvard is in nonlinear optics, frequency conversion, laser damage, short optical pulses and optical phenomena in liquid crystals; the structure and properties of amorphous materials such as Ge and Ge-Sn; fabrication of fine-grained (50-300A) optically transparent ceramics (BaTiO3, KDP, NaNO3) by the freeze-dry technique; control and modeling of large systems and networks, decision-making and trade-offs, and in the electromagnetic theory of antennas and radiating systems.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0020, UNSTEADY SHOCK WAVE MOTION IN TRANSONIC FLOW
T.C. ADAMSON, Univ. of Michigan, School of Engineering, *Ann Arbor, Michigan* 48106 (DN590160; N00019-76-C-0435)

To study the unsteady motion of shock waves in two-dimensional transonic channel flow.

Analytical methods developed by the investigators will be used in making numerical computations for specific inviscid unsteady transonic channel flow fields involving characteristic times in the range of technical importance, shock waves at various initial locations, and impressed unsteady pressure fluctuations at a specified downstream location. Results will include wall and centerline pressure distributions, and velocity distribution as function of time. An attempt will be made to ascertain under what conditions steady flow predictions of flow separation may be used in unsteady flows, and to estimate the characteristic time associated with the growth or collapse of a separated flow structure so that the lag between the shock motion and flow reattachment or separation can be estimated.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0021, WEAPONRY - STRESS AND STRAIN MEASUREMENT IN SOLID PROPELLANTS AND OTHER NAVAL STRUCTURES
A.J. DURELLI, Oakland University, School of Engineering, *Rochester, Michigan* 48063 (DN675227; N00014-76-C-0487)

The objectives of this research program are to develop advanced photoelastic laser techniques and experimental stress methods for complex naval structural systems such as aircraft and ships. The developments in dynamic photoelasticity and holography have important applications in the design of structures able to withstand earthquakes and shocks. The gravitational studies have application in the design of high-acceleration rockets and in the design of dams. The studies conducted on composite materials can be applied to the design of rocket motor cases, as well as to the design of reinforced rocket fuel.

Research under this contract will deal with the use of dynamic holography, brittle coating, dial gages, strain gages and three-dimensional photoelasticity. These techniques will be used to determine stresses in boxes with various wall thicknesses subjected to internal pressure and concentrated loads. Strain transformation equations will be developed in such a way as to apply to a 'Mohr-circle' approach for large strain problems as in plasticity in metal forming.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0022, HYDROFLUIDIC SERVOACTUATOR FOR AN EJECTION SEAT
UNKNOWN, Honeywell Incorporated, *Minneapolis, Minnesota* 55413 (DN590125; N00019-76-C-0374)

The objective of this program is to develop a hydrofluidic servoactuator for use on an ejection seat control system.

A rotary servoactuator will be designed, fabricated and tested based on a specific set of requirements.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0023, NAVY VEHICLE DESIGN AND CONSTRUCTION - VISCOUS FLOW FIELDS AND AIRFRAME FORCES INDUCED BY TWO-DIMENSIONAL LIFT JETS IN GROUND EFFECT
D.R. KOTANSKY, McDonnell Douglas Corporation, *St. Louis, Missouri* 63166 (DN675330; N00014-76-C-0494)

To develop the predictive techniques for viscous (turbulent) flow produced by the operation of high-performance VTOL aircraft in ground effect. These techniques will provide accurate

prediction of induced forces acting on the airframe since knowledge of these forces is required for propulsion system sizing and aircraft stability and control analyses.

The approach will be to solve the time-averaged Navier-Stokes equations and a transport equation for the turbulent kinetic energy of steady, two-dimensional, incompressible, turbulent, vectored and invectored, impinging jets. The flow field solutions for six configurations will be compared with data from tests being conducted by McDonnell Douglas research laboratories and the computational model will be improved as required. The results will be a definition of the turbulent jet-entrainment process for a lift jet issuing from a two- dimensional airframe under surfaces in ground effect and the resulting influence on the airframe surface, and a computational procedure for calculating the associated flow fields utilizing a mathematical model of turbulence.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0024, DEVELOPMENT OF FLIGHT LOAD AUTOLOGGER

E. SELEMI, Conrac Corporation, *Caldwell, New Jersey* 07006 (DN581064; N62269-74-C-0676)

Provide advanced strain level recorder to advance the Navy's fatigue monitoring program. This contract is performed under work unit ZA101, Agency Accession No. DN681080.

Develop an instrument which records sequentially the peak strains to which a structure has been exposed. Recording is on a magnetized disc. All subcontracted parts have been delivered.

ADDENDA: Supporting agency address is: Naval Air Development Center, Air Vehicle Technology Dept., Warminster, Pennsylvania 18974

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0025, NON-INTEGRATED ENGINE DIAGNOSTIC INSTRUMENTATION SYSTEMS

G. BUCSEK, U.S. Navy, Air Engineering Center, *Lakehurst, New Jersey* 08733 (DN696018)

To effectively develop and/or improve ground support equipment (GSE) for testing, diagnosing, and maintaining propulsion systems in existing naval aircraft, thereby: (1) Increasing time between overhauls for present day engines. (2) Increasing maintenance system effectiveness. (3) Decreasing skill levels required for utilization of diagnostic systems and equipment.

Contract for a study and analysis to identify most frequent propulsion system failure modes. Contract for a study of commercial and military engine diagnostic capabilities and techniques. Establish liaison with commercial organizations and military agencies involved in the development of diagnostic techniques and equipment. Develop and apply data handling procedures to allow simplified equipment operation and integral decision-making capability. Develop prototype diagnostic equipment utilizing new technology in data handling and state-of-the art detection and diagnostic techniques.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0026, PREDICTION OF SUPERSONIC COMPRESSOR FLUTTER PARAMETERS

F. SISTO, Dynalysis of Princeton, *Princeton, New Jersey* 08540 (DN590145; N00019-76-C-0444)

To develop and verify a prediction method for supersonic compressor flutter.

The prediction of flutter parameters of a typical supersonic compressor or fan stage will be based on a computer program currently being developed by contractor under prior contract N00019-74-C-0378. An experiment will be designed for the purpose of confirming these parameter values.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0027, WEAPONRY - TRANSVERSE TELD FOR MULTIGIGABIT DECISION MAKING

Y. NARAYAN, Radio Corporation of America, *Princeton, New Jersey* 08540 (DN675208; N00014-76-C-0465)

This work seeks to provide electronic logic speeds sufficient to provide subsecond threat reaction times for Navy ships and aircraft.

The phenomenon of the transverse spreading of a dipole domain will be modeled so as to design an optimized exclusive 'or' gate operating at clock speeds exceeding 5gHz. The transverse domain spreading will be exploited to eliminate parasitic interelement loading experienced in all other forms of logic devices. Other logic functions (e.g., and, or, nor gates) will also be designed.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0028, ADVANCED ELECTRONIC FLIGHT CONTROL SYSTEM DEVELOPMENT

E.C. HILL, General Electric Company, *Binghamton, New York* 13902 (DN681021; N62269-75-C-0286)

To fabricate eight new technology solid-state rate sensors (VYRO) for application to the Navy Advanced Flight Control System Program. This contract supports work unit DJ901, Agency Accession No. DN833075.

Fabricate new sensors using advanced production techniques to improve reliability, lower quality control requirements, and reduce production costs.

ADDENDA: Supporting agency address is: Naval Air Development Center, Air Vehicle Technology Dept., Warminster, PA

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0029, DICEF UPGRADE

J.B. MCEVOY, U.S. Air Force, Rome Air Development Ctr., *Rome, New York* 13442 (DF721090)

To upgrade the Digital Communications Experimental Facility (DICEF) so that the facility is in a continuing position to provide the maximum benefit to the Air Force Digital Communications Program.

Acquire, install and modify as required the C-8500 communication processor, part of the ESCELS system, so that the DICEF may perform real-time data acquisition and analysis of digital communications systems and equipment operating at data rates up to 40 megabits per second. Associated with this upgrade, and a part of it, are the actions and findings of the DICEF study committee which identifies broad areas of future endeavor and related required capability.

ADDENDA: Supporting agency address is: Rome Air Development Center DCL, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0030, STATISTICAL COMMUNICATION THEORY AND RANKING AND SELECTION PROCEDURES

S. CAMBANIS, Univ. of North Carolina, School of Arts & Sciences, *Chapel Hill, North Carolina* 27514 (DF040530; AFAFOSR-2796-75)

Air Force function - communication systems and signal processing, ranking and selection procedures for industrial or military components. Deficiency - improvements are needed in the techniques of identification of signals observed through nonlinear devices, and in the calculation of the rate of transmission for reliable communication of various classes of information sources. The need is obvious for easy-to-apply ranking and selection procedures with known small-sample properties, when evaluating very expensive components. Objective - improve the understanding of the operations of communication systems and further develop signal processing methodology. Develop methods to control the precision of estimates that arise in such diverse fields as reliability theory and quality control. Further develop the methods used in ranking and selection procedures with particular attention to small-sample properties. How the work contributes -

the research suggested will allow for better design of communication systems and signal processing techniques. It also improves the precision of estimates for the parameters of interest and make available ranking and selection procedures that can be implemented when we have only a small number of test items to use for the decision.

The proposed research in communication systems and signal processing include the study of nonlinear estimation and prediction, linear regression, and sample functions of stable processes, the identification of signals observed through nonlinear devices, the robustness of certain nonlinear systems, the construction of designs for certain regression problems, and the calculation of the rate of transmission for reliable communication of various classes of information sources. Another area of study is based on the problem of robust fixed-width confidence intervals and related ranking and selection procedures. A large-scale comparative Monte-Carlo experiment will study their small-sample behavior over a wide class of distributions. Robust sequential elimination rules will be developed for the selection problem.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NM, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0031, MODULE DEVELOPMENT FOR THE STAGING SYSTEM

L.E. HULBERT, Battelle Memorial Institute, *Columbus, Ohio* 43201 (DF138240; F33615-76-C-3125)

The use of finite-element methodology in the design of structural components contributes significantly to the effectiveness and efficiency of flight vehicles. There is a need to accelerate the data handling requirements normally associated with using this methodology. The objective of this effort will be directed toward the enhancement of the Air Force staging system by providing new modules, postprocessing and materials data base, not yet developed, by enhancing the display and edit and the generalized data base modules already developed, and by providing a limited number of analysis modules for evaluation of the total system. These additional capabilities will provide necessary automation of many time-consuming tasks normally associated with using the finite-element methodology.

The postprocessing and material data base modules will be designed, coded and integrated into the staging system. Concurrent with this effort, enhancements will be made to the display and edit module and generalized data base. Finally, selected existing analysis codes will be integrated into the staging system to evaluate the system.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FBR, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0032, ION-IMPLANTED SEMICONDUCTORS

J.D. MOORE, Systems Research Labs. Inc., *Dayton, Ohio* 45432 (DF104990; F33615-76-C-1166)

The proposed work will utilize ion implantation as a principal technique for doping materials with a wide variety of ions in a reproducible manner. This should be a thorough program in which (1) the intrinsic material is carefully characterized, (2) the implantation process is precisely controlled and analyzed with suitable techniques as needed, (3) the implanted layers are characterized by electrical, optical, Rutherford backscattering, channeling, and proton-induced characteristic x-ray analyses. Emphasis will be placed on application of light-ion bombardment. Parallel characterization of undoped and doped crystals is encouraged to aid in identification of the unique features of ion-implanted layers. The goal of this program is to apply ion implantation to the problem of device formation and to solve some of the technological problems associated with ion implantation doping of compound semiconductors.

The proposed work will characterize ion implanted layers with electrical measurement techniques such as Hall, c-v, and fast capacitance measurements and correlate these measurements with studies of the concentration profiles and atomic positions of dopants as revealed by proton-induced characteristic x-ray spectroscopy (PIX), Rutherford backscattering (RBS), channeling and optical measurements.

ADDENDA: Supporting agency address is: AF Avionics Laboratory DHR, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0033, IN-HOUSE TEST OF A HIGH-SPEED VANE PUMP

K.E. BINNS, U.S. Air Force, Aero Propulsion Lab., *Dayton, Ohio* 45433 (DF458380)

To establish the technical merit of high-speed vane pumps for use in future aircraft hydraulic systems.

Testing of a 30000 rpm vane pump delivered under an AFAPL contract and a 15000 rpm vane pump obtained from F-100 engine surplus will be conducted to establish their efficiency, stability and durability characteristics.

ADDENDA: Supporting agency address is: AF Aero-Propulsion Laboratory POP, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0034, ND-SOAP MINI-LASER TARGET DESIGNATOR

M.M. HEIL, U.S. Air Force, Avionics Laboratory, *Dayton, Ohio* 45433 (DF097370)

To provide a technology for development of simple, efficient, high- radiance target designators for long-range laser-aided weapon delivery systems. A secondary objective will be to reduce countermeasure vulnerability due to the wavelength separation of ND-SOAP relative to ND-YAG.

This program will combine two new technologies. These are the mini- face pumped laser (FPL), a thermal-optic distortion reduction laser configuration, and an increased energy storage laser material, ND-SOAP. the use of an increased energy storage material will allow attaining 500-1000 millijoules in a single oscillator. However, the thermal optic distortion of ND-SOAP in round rod form will not allow near diffraction limited performance. Thus it is planned to design and build a ND-SOAP target designator in the mini-FPL configuration. It is anticipated that material will be available in a size to allow operation at 500 millijoules per pulse and 10-20 pps. The residual thermal-optic distortion will be studied. Another important area of investigation will be mode control techniques to allow efficient use of the slab volume in low-order mode operation.

ADDENDA: Supporting agency address is: AF Avionics Laboratory DHO, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0035, FLUID POWER COMPONENT SURVIVABILITY

E.C. FITCH, Okla. St. Univ., School of Mechanical Engin., *Stillwater, Oklahoma* 74074 (DN675019; N00014-75-C-1157)

The objective is to determine the upper limit of contamination concentration as a function of particle size necessary to maximize the survivability of the Navy's high-performance fluid power systems in aircraft, ships, and submarines.

The approach is to determine the effect of varying the concentration and size of particulate contamination on the wear rate of rotary and linear fluid power components. Contaminant level will be controlled by the amount of contaminant added and by removing particulates created in-situ while the components are operating. Wear rates will be monitored using ferrographic analysis.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0036, ENERGY CONVERSION - PULSED, SELF-EXCITED MHD POWER GENERATOR

B. ZAUDERER, General Electric Company, *Philadelphia, Pennsylvania* 19101 (DN524428; N00014-73-C-0039)

The overall objective of this program is to deliver kilojoules of energy output from a pulsed, self-excited MHD generator under plasma conditions obtainable with chemical explosives. This will provide the Navy with a high-energy density pulsed power source.

The generator will be developed in stages. Initially, a partially self-excited MHD generator channel will be tested. This channel

is designed to significantly augment the externally applied magnetic field. Then the government electric arc shock tunnel facility at NASA Ames Research Center will be adapted for testing a prototype pulsed self- excited MHD generator which will be designed and built for use with that facility. This generator will be tested to determine design criteria for an explosive-powered, pulsed, self-excited MHD generator.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0037, SURVEILLANCE - MERCURY-PUMPED DYE LASER

N.T. MELAMED, Westinghouse Electric Corp., *Pittsburgh, Pennsylvania* 15235 (DN675605; N00014-76-C-0935)

Naval requirements for underwater mapping, underwater surveillance, and submarine-to-airplane communications demand high efficiency blue- green lasers; this contract will attempt to maximize the efficiency from a blue-green dye laser by matching the output of a pulsed mercury lamp to the dye laser pump band.

A high-pressure, pulsed mercury lamp will be doped with metal halide additives to maximize the efficiency from a blue-green dye laser. Repetitive 1-joule pulsing will be tried to learn what scale-up limitations will be encountered in higher average power systems.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0038, ADVANCED ELECTRONIC FLIGHT CONTROL SYSTEM DEVELOPMENT

C.R. ABRAMS, U.S. Navy, Air Development Center, *Warminster, Pennsylvania* 18974 (DN833075)

To initiate, evaluate and assist in the development of advanced AFCS (automatic flight control systems) for new Navy aircraft. The procedure is to utilize improved technologies in airborne digital computers, FBW (fly-by-wire) control systems, solid-state sensors, data management systems and in flight identification techniques to produce a combat-survivable, fail-operational failure-detectable and easily maintainable flight control system. Since new aircraft will require full-time stability augmentation, secondary objectives are improved redundancy and monitoring techniques to provide ultra-reliability.

Investigations will be made to determine the feasibility of digital flight control computers, solid-state sensors, FBW interfaces, actuator interfaces, integrated control/display systems and reliability techniques. A consequence of these investigations will be the formulation of new criteria to update specification MIL-C-18244A. Effort is supported by contracts as reported in work units DJ90LB, B1 and B2.

ADDENDA: Supporting agency address is: Naval Air Systems Command (340D), Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0039, HEAVY-LIFT AIRSHIPS, TECHNOLOGY SUPPORT

J.A. ENEY, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN581478)

To provide technical support, guidance, and contract monitoring to NavAirSysCom (AIR-03P3) during the heavy-lift airship research and development program. This includes conceptual design studies, wind- tunnel testing, remote-controlled model flight testing, and prototype experimentation.

Two vehicle concepts are under consideration, the 'rotor-balloon' with a rigid rotor affixed to an aerostat centerbody, and the 'quad- rotor' with four articulated rotors flanking and ellipsoidal hull. Both concepts are being carried through model testing and simulation phases. A preferred configuration, when determined, will be prototyped and flight-tested.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Advanced Systems Concepts Div., Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0040, BUOYANT AND SEMI-BUOYANT VEHICLE TECHNOLOGY DEVELOPMENT

J.A. ENEY, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN681032)

Accelerate the development of a Navy lighter-than-air vehicle technological capability to a level enabling comprehensive engineering and operational evaluation of any given buoyant or semi-buoyant air vehicle system.

Several technological sub-areas have been selected to be concurrently and complementarily developed: (1) aerodynamics and aerostatics, (2) flight dynamics (stability and control), (3) structures and materials, and (4) propulsion systems. The full scope of LTA vehicle systems expertise will be developed to reside at NavAirDevCen in a concentrated, integrated form responsive to conducting and evaluating total LTA vehicle system designs.

ADDENDA: Supporting agency address is: Naval Air Development Center, Warminster PA

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0041, SMALL REFRACTIVE INDEX RADIOSONDE

S.J. GRILLO, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN581419)

Demonstrate the feasibility of a small, compact refractive index radiosonde and associated portable instrumentation for use on small vessels at sea to identify refractive conditions affecting surveillance radar performance such as holes and range limitations.

Identify user requirements and operation. Design and develop a very lightweight mini-radiosonde unit and shipboard support receiver and data processing equipment. This equipment will be used primarily to provide the necessary data to predict the performance limits and validity of the surveillance radar in its operating environment.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Tech Admin (Surveillance), Washington, DC

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0042, FLUERICS/FLUIDICS FOR NAVY AIRCRAFT AND MISSILE SYSTEMS

E.T. SCHMIDT, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN833162)

To provide technical support for NavAirSysCom in the selection, development of technical requirements, and monitoring of fluidic research and development programs. To provide laboratory test facilities and technical capability to support this work.

This effort involves scheduling, technical monitoring and laboratory/flight evaluation of fluidic systems or components resulting from in-house development and the following fluidic system contracts: A. Fluidic overspeed limiter for the F-14 air cycle machine. B. Hydrofluidic flight control (fly-by-tube). C. Fluidic autopilot for Sparrow III missile. D. Hydrofluidic yaw damper for TH-57 helicopter. E. Environmental testing of the fluidisc angular rate sensor. F. Applications for flex valve concept to actuation systems.

ADDENDA: Supporting agency address is: Naval Air Systems Command (340C), Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0043, CARRIAGE LOADS CORRELATION

R.E. DIX, Arnold Research Org. Inc., *Tullahoma, Tennessee* 37389 (DF420911; F40600-75-C-0001)

Since normal force and pitching moment exert significant influence on the trajectory a store follows after release, it is important to correctly position the store with respect to the captive position during wind-tunnel tests. This positioning technique needs to be refined for both internal-balance support and dual support tests. In addition, both internal support and dual support methods require correlation with flight-test data to establish their validity.

A wind-tunnel test program will be conducted in the PWT/4T wind tunnel to evaluate better bracket designs for both internal support and dual support testing. Flight-test data ob-

tained from the in-flight measurement of captive loads acting on a dummy MKt83 store will be correlated with wind tunnel captive loads previously obtained.

ADDENDA: Supporting agency address is: Arnold Engineering Development Center, Arnold AFS, TN 37389

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0044, MASTER MONITOR DISPLAY FOR FUTURE NAVAL AIRCRAFT

P. GREER, L T V Aerospace Corporation, *Dallas, Texas* 75222 (DN781226; N62269-76-C-0198)

To determine the optimum design characteristics for a master display surface. This contract supports work unit ZA101, R monitor display for the 1980 ERA aircraft. The MMD is intended to provide the pilot with warning, caution, mode advisory, function failure, and auxiliary information on a single display surface. This contract supports work unit ZA101, Agency Accession No. DN681080.

The contractor will provide the necessary supplies and services to conduct an application study of the MMD system to the A-7E aircraft.

ADDENDA: Supporting agency address is: NADC, Air Vehicle Technology Dept, Warminster, PA

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0045, THERMAL STRESS INSTRUMENTATION

A.D. BERGQUIST, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF320100)

The purpose of this project is to design and construct a modified miniature environmental monitor (MEM) for use by the USAFEHL in conducting field thermal stress studies. Instrumentation presently available for thermal stress surveys are behind current technology, require frequent calibration, are of questionable precision, and do not measure all of the variables affecting the heat transfer of bodies within an environment. This joint effort will augment existing USAFSAM capabilities of field data collection and provide additional input, as a data base, to the thermal stress program.

In order to meet the Environmental Health Laboratory's needs, USAFSAM/VNT plans to modify the design of the existing MEM to include multiple black globes and temperature sensors. Also, a digital recording system will be utilized to increase total system accuracy.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0046, SURVEILLANCE - PRIMARY PHOTOPROCESSES

M.W. WINDSOR, Washington State University, School of Arts & Sciences, *Pullman, Washington* 99163 (DN223328; N00014-75-C-0535)

Tunable lasers and, in particular, dye lasers are of considerable interest to the Navy for application in communication systems, in systems for underwater photography and in systems for rescuing downed naval aviators. Limited accessibility for servicing and restrictions on available space place a high premium on reliability and the overall electrical efficiency of such systems. It is the purpose of this research to find and to study short-lived, light-absorbing species in dye lasers. The data obtained will be used to recommend changes in the molecular structure of the dyes that will lead to improved laser reliability and efficiency.

The development of a single picosecond pulse laser will continue in a search for absorbing species in dyes with picosecond lifetimes. Data including thresholds, energy efficiencies, pulse energies and durations, and behavior with respect to quenchers are being obtained for selected dyes such as triphenylmethane derivatives. Performance is being correlated to molecular structure of the dyes in an attempt to obtain new, improved dye lasers.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0047, INVESTIGATION OF THE ELECTROMAGNETIC CHARACTERISTICS OF COMPOSITE AEROSPACE STRUCTURES UNDER OPERATIONAL CONDITIONS

R. BRICK, Boeing Company, *Seattle, Washington* 98108 (DN590065; N00019-75-C-0435)

To determine the effects of electromagnetic energy on aircraft composite structures and their avionic/electrical equipment and prepare operational requirements for Navy specifications.

Conduct analysis of company data on composites airframes and do the required laboratory exploratory development in areas such as bonding, grounding, shielding, etc. to develop operational parameters for avionic/electrical equipment installations. The effects of lightning, P- static, nuclear EMP, antenna EMI, electrical power returns, data signal transmission lines, grounding, shielding, bonding, and equipment EMI, will be investigated in boron and graphite composite structures.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, DOPPLER REMOTE MONOSTATIC WIND MEASURING SYSTEM

J.S. FARRIER, Lockheed Missiles & Space Co., *Huntsville, Alabama* 35807 (DA0F1051; DAAH01-75-C-1057)

Design and fabricate a CO2 laser Doppler remote monostatic wind measuring system that measures wind velocity and direction at various altitudes of from 10 to 640 meters. Interface this system with the WSMR data gathering and evaluating system.

The components will be designed, fabricated and assembled as a system and installed in a GFE van and set up for test range wind field observations.

ADDENDA: Supporting agency address is: MICOM Aeroballistics Directorate, US Army Missile RD&E Laboratory, US Army Missile Command, Redstone Arsenal, AL 35809

SUPPORTED BY U.S. Dept. of Defense - Army

5.0002, ATMOSPHERIC INFLUENCES ON ECOSYSTEMS AND SATELLITE SENSING

J.D. MCKENDRICK, Univ. of Alaska, Inst. of Agricultural Sciences, *Palmer, Alaska* 99645 (0061628; ALK05520)

OBJECTIVE: Develop methods for evaluation and utilization of remotely sensed data pertaining to agricultural ecosystems from ERTS and aircraft. Evaluate environment effects by use of a chemical reaction temperature integrator and an inter-regional phenological network.

APPROACH: Low-, medium- and high-altitude aerial photography and ground investigation will be applied to the problems of identifying vegetation types such as grassland, tundra, swamps and forested areas in south-central and southwestern Alaska and in certain river drainages where agricultural potential is thought to exist. Indicators may be found permitting the identification of permafrost areas by remote sensing. A phenological network will be established using adopted plant materials with parent stocks maintained at Palmer and College, Alaska. Plant materials furnished from the NE-69 regional project will be propogated and observed.

PROGRESS: A vegetation map for the Anchorage C-7 Quadrangle (1:63,360 scale) was produced from LANDSAT 1 CCT data. The color coded transparency was produced on a Dicomed D-47 color printer from computer- processed data. A false-color map of the same area was also generated from the CCT data. Copies of the original USGS range and township and section lines (1:63,360 scale) were purchased with plans to publish these maps to demonstrate the compatibility of automated production techniques for producing vegetation maps. An additional value to this demonstration was in relating LANDSAT data to an existing USGS map and conventional, cadastral survey units.

SUPPORTED BY U.S. Dept. of Agriculture - C.S.R.S.

5.0003, ATMOSPHERIC DUST LOADING
B.M. HERMAN, Univ. of Arizona, Inst. of Atmospheric Physics, *Tucson, Arizona* 85721 (DN624031; N00014-76-C-0438)

The objective of this research is to use lidar backscattering data supplemented by other optical data to derive the distribution of atmospheric particulates with altitude. Improvement of the operation of naval weaponry dependent upon electrooptic systems constitutes the naval relevance of this research.

The size and distribution of the aerosol content of the atmosphere is in general derived from observations of radiative transfer in the atmosphere. These observations include measures of the ratio of direct to diffuse sunlight at various wavelengths, radiometer measurements at eight wavelengths, backscatter measurements with monostatic and bistatic lidar, and narrow band solar flux sensors to measure flux incident at ground.

ADDENDA: Supporting agency address is: Office of Naval Research 465, Arlington, VA. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0004, AN EXPERIMENTAL AND THEORETICAL EVALUATION OF THE INFLUENCE OF ATMOSPHERIC AEROSOLS ON SOLAR RADIATIVE TRANSFER
B.M. HERMAN, Univ. of Arizona, School of Liberal Arts, *Tucson, Arizona* 85721 (ATM75-15551 A01)

This research seeks to determine experimentally, and verify theoretically, the influence of atmospheric aerosols on the transfer of solar radiation in the earth-atmosphere system. An array of instruments in Arizona will measure directly, or infer indirectly, pertinent aerosol parameters. The parameters will then be employed as input data for theoretical models for the computation of the solar radiation field. Ground-based instrumentation will be utilized on a more or less routine basis, but larger-scale cooperative field programs with other groups are also planned. These cooperative efforts will employ additional instrumentation, both ground-based and airborne, to provide additional data, and to provide a check against the ground-based inferences. Simultaneous measurements of the solar radiative fluxes will be made to determine the degree of agreement between observation and theory. An important objective of this work will then be to determine the degree of usefulness of ground-based inferences of aerosol parameters for the purpose of computing radiative transfer.

The objectives of this continuation research remain experimental and theoretical evaluations of the effects of atmospheric aerosols on solar radiation in the lower atmosphere.

SUPPORTED BY U.S. Natl. Science Foundation

5.0005, PHYSIOGRAPHIC CLASSIFICATION OF SOUTHERN PINE FOREST LANDS
P.E. POPE, Univ. of Arkansas, Agric. Experiment Station, *Fayetteville, Arkansas* 72701 (0061232; ARK00759)

OBJECTIVE: Organize physiographic land patterns into a system having a significance and utility for resource managers. Develop a physiographic map of southern region using the new system.

APPROACH: Current information on physiography, soils, and surface geology related to forest vegetation will be analyzed and coordinated. Localized information will be reorganized to form a unified regional system. Map development will be on a state basis, utilizing local authorities, aerial photography, and space imagery when appropriate.

PROGRESS: The project is proceeding under the direction of Dr. Earl J. Hodgkins, Auburn University. ERTS photographs obtained from Mr. F. Miller, Mississippi State University, last year are being assembled and arrangements are being made for a review of the soon-to-be completed photograph. A state soils and topographic maps have been obtained for correlation with the ERTS photographs.

SUPPORTED BY U.S. Dept. of Agriculture - C.S.R.S.

5.0006, STUDIES OF COASTAL AND SHALLOW WATER GEOLOGY
D.S. GORSLINE, Univ. of Southern California, School of Letters Arts & Sci., *Los Angeles, California* 90007 (DN675072; N00014-76-C-0061)

The use of satellite imagery as an investigative tool in coastal research is emphasized in this effort in which two major areas of research are addressed: (1) circulation in coastal waters, and (2) coastal processes in hypersaline environments. This effort will contribute significantly to an improved understanding of the coastal environmental processes which affect a variety of Navy and Marine Corps inshore operations.

The surface circulation over the continental shelf near San Pedro, California will be delineated through the use of ERTS imagery in combination with hydrographic cruises during which ground-truth measurements will be made of surface suspended load and current velocity, turbidity distribution in the vertical, temperature, and salinity. ERTS imagery will also be employed to determine times and extent of flooding of coastal depressions and lagoonal tidal flats in southern California and Baja California, and comparisons to ground observations of the surficial characteristics will be made under wet and dry conditions. Rates of development and trafficability will be tabulated and compared to other coastal areas of similar type using ERTS imagery and data taken from the scientific literature.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0007, NAVY ENVIRONMENT - MAGNETO-IONOSPHERIC PLASMA
E.G. SHELLEY, Lockheed Missiles & Space Co., *Palo Alto, California* 94304 (DN575039; N00014-75-C-0099)

DOD interests in ionospheric communications, radar propagation, and high-altitude nuclear weapons effects require an understanding of the fundamental ionospheric and magnetospheric processes which are essential to reliable models for predicting ionospheric characteristics during disturbed conditions. A previous experiment S71-2 (ONR 001) discovered intense fluxes of oxygen and helium singly charged ions with energies of up to 12 Kev precipitating into the atmosphere during magnetic storms. energetic oxygen ions were also found to be present in the magnetosphere, and the presence of such large fluxes of ions in the Kev range points to the existence of an ionospheric acceleration mechanism and energy source of geophysically important magnitude, previously undetected.

The experiment is an energetic ion mass spectrometer and a multi- channel electron spectrometer which measures low-energy ions and electrons in the range from a fraction of a Kev to about 30 Kev. The opportunity to use heavy ions as tracers to probe mass and charge- dependent magnetospheric processes will furnish a new technique to study the still-unknown mechanisms responsible for the energization and transport of magnetospheric plasma. A measurement with higher sensitivity and better mass resolution will be performed and extended to energy ranges not covered in the previous experiment. The possibility also now exists of performing active experiments in coordination with chemical releases planned by DNA, NASA, and the Max-Planck Institute of Germany.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0008, EVALUATION OF A MULTI-SENSOR, AIRBORNE GEOPHYSICAL SYSTEM
M.L. MCCAULEY, State Transp. Laboratory, *Sacramento, California* 95819 (100578 (HRB NO.))

The purpose of this project is to determine the value of the Barringer multi-sensor airborne geophysical system in determining geologic conditions for highway design. /FHWA/

ADDENDA: Document provided to S.S.I.E. by the H.R.I.S. This project is also supported by: California Department of Transportation.

SUPPORTED BY U.S. Dept. of Transportation - F.H.A.

5.0009, INVESTIGATIONS OF HIGH-LATITUDE IONOSPHERIC ABSORPTION

H.J. CHIVERS, Univ. of California, Graduate School, *San Diego, California* 92037 (DPP76-80556)

The objective of this research is to investigate the detailed processes controlling the interactions of the magnetosphere and the ionosphere. The investigations will be made using observations made with a network of newly developed riometers which measure the ionospheric absorption of cosmic radio noise at Siple, South Pole, and McMurdo Stations in Antarctica and at Roberval and Frobisher Bay in Canada. Ionospheric absorption profiles will be compared with simultaneous ground-base and satellite observations of VLF phenomena and magnetic and photometric effects.

The Principal Investigator will visit McMurdo, South Pole, and Siple Stations in Antarctica in the austral summer of 1976/77 and 1977/78.

SUPPORTED BY U.S. Natl. Science Foundation

5.0010, NAVY ENVIRONMENT - SEA FLOOR ELECTROMAGNETIC FIELD STUDIES

C.S. COX, Univ. of California, Graduate School, *San Diego, California* 92037 (DN475387; N00014-75-C-0999)

This research is to measure the electrical signals on the sea floor, both to determine the electromagnetic environment of that region as it relates to internal waves and currents, and to infer the conductivity of the underlying crust. Such data on the physical properties of the oceanic crust are important to the Navy as they relate to underwater sound propagation, ocean currents and internal waves (which also generate EM signals) and communication.

Data were acquired in a field program last year. This renewal will support the analysis of these data. Electromagnetic signals which were observed on the sea floor originated from micropulsation sources (sferics, solar wind, disturbances in the magnetosphere, etc.) and propagation through the earth's crust from an entry point near the shoreline.

ADDENDA: Supporting agency address is: Office of Naval Research 463, Arlington, VA. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0011, ENVIRONMENTAL REMOTE SENSING

H.M. BYRNE, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8B326328)

PROJECT OBJECTIVE: To study ocean circulation, tides, waves, and sea state from satellites, aircraft, and ships using remote-sensing techniques to conduct theoretical and numerical analysis of same. To define future satellite systems for ocean research.

CURRENT YEAR PLAN: Develop techniques and conduct field experiments in support of the NOAA SEASAT-A program. Initiate programs in ocean currents, waves and sea temperature using spacecraft, aircraft and ship data; develop theories and models.

PROGRESS REPORT: SEASAT-A PDP drawn up. Image enhancement computer facility completed. Major research project on internal waves near completion.

SUPPORTED BY U.S. Dept. of Commerce - N.O.A.A.

5.0012, STRATOSPHERIC MODELING

P.J. CRUTZEN, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8DJ4 41 84)

PROJECT OBJECTIVE: The development of a physical-chemical model of the stratosphere which can be used to predict the effects of natural and man-made chemical compounds and any other processes which have the potential for altering the present natural balance in the stratosphere.

CURRENT YEAR PLAN: Improve current models of the global distribution of stratospheric constituents using reaction rates for significant chemical and photochemical reactions, and the dynamic processes of the stratosphere.

PROGRESS REPORT: The stratospheric model has been expanded to include several chloro-fluoro-methanes and ethanes along with the chlorine nitrate sink. Current calculations predict a 1% ozone depletion at present. Good agreement is found between calculation and measurement for fluorocarbons 11 and 12. The effects of inaccuracies in parameters such as reaction rates and eddy diffusion coefficients has been studied.

SUPPORTED BY U.S. Dept. of Commerce - N.O.A.A.

5.0013, EM RADIATION-TORNADOES

W. TAYLOR, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8C37 12 42)

PROJECT OBJECTIVE: Study electromagnetic radiation from thunderstorms and relate electrical characteristics with the dynamic properties of thunderstorms as determined from Doppler radar, fast field change, weather radar and location of lightning from photographic and acoustic means.

CURRENT YEAR PLAN: Report findings from electromagnetic tornado detection study. Analyze data from Florida experiment, and conduct experiments to determine space-time history of storm discharge processes and compare with storm dynamic processes in Florida and Oklahoma.

PROGRESS REPORT: Tornadic storm detectors deployed at 4 locations during 1976. Completed analysis of the sector-directional tornadic storm data for 1975. Operated 2 space-time history observing sights at Kennedy Space Center, Florida, during June and July in cooperation with other atmospheric electricity workers.

SUPPORTED BY U.S. Dept. of Commerce - N.O.A.A.

5.0014, THUNDERSTORM DETECTION

K.E. WILK, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8C370404)

PROJECT OBJECTIVE: Design, install, and test a network of surface stations capable of digitally recording and telemetering the wind speed and direction suitable for immediate mesoscale observation of the low- level airflow in the environs of severe storms. In addition, provide accurate, compiled data fields of wind velocity, temperatures, pressure, humidity, and rainfall in a form suitable for post-mesoscale synoptic analysis of severe storm period. Operate a tall meteorological tower and radiosonde station and obtain meteorological profiles of wind, temperature, and humidity in the lower and middle troposphere during severe storm periods. Continue the analysis of severe storm events including hailfalls, heavy rainfall, tornadoes, and strong wind gusts and relate these events to the quantitative weather radar data. Develop techniques for the analysis, display, and tracking of severe storm events for the improvement of severe thunderstorm warnings.

CURRENT YEAR PLAN: Continue the collection and analysis of severe storm events including surface wind gusts, heavy rainfall, and hail. Analyze the radar reflectivity data to determine the motion, predictability and water output characteristics of the severe thunderstorms associated with the events.

PROGRESS REPORT: The development and testing of digital processing and recording equipment for the tower and remote surface sites is continuing. The characteristics of radar and surface network observations collected during severe storms were analyzed and documented for publication. Computer processing techniques were developed for analyzing and communicating radar data, to provide detailed and accurate contoured displays at FAA and NWS facilities remote from the radar.

SUPPORTED BY U.S. Dept. of Commerce - N.O.A.A.

5.0015, SATELLITE STUDIES OF SEVERE CONVECTIVE STORMS

T.H. VONDERHAAR, Colorado State University, School of Engineering, *Fort Collins, Colorado* 80521 (ATM76-21307)

This research attempts to evaluate the capability of satellites to measure the three-dimensional distributions of temperature and moisture using existing techniques of remote sounding, and to infer horizontal air motions from cloud drift. Comparisons will be made using a special network of radiosondes. Specific emphasis is on mesoscale phenomena, though synoptic scale comparisons will also be made to determine how satellite sounding data might best be combined with the present radiosonde network over the U.S.

Several data sets are already available. The work was to have also included data sets from the proposed SESAME (Severe Environmental Storms and Mesoscale Experiment) which, however, will not take place in time for this study.

SUPPORTED BY U.S. Natl. Science Foundation

5.0016, NAVY ENVIRONMENT - COMMITTEE ON GEODESY -- NAS

J.W. BERG, Natl. Acad. of Sciences, *Washington, District of Columbia* 20037 (DN675178; N00014-76-C-0411)

A detailed understanding of the earth's geoid and gravity field is vital to Navy operations such as FBM launch and targeting calculations and to precise navigational control of fleet units. A complete coverage of the world's oceanic areas to the detail required by present operations is not possible in the time frame of the next few decades with the available facilities. A new approach to this problem through the use of space instrumentation should be investigated to meet these Navy requirements.

The National Academy of Sciences will establish a Committee on Geodesy to examine the application of new generation of space-borne instruments to geoidal and earth gravity measurements from outer space.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0017, FAR IR ENVIRONMENTAL LIMITS TO MILITARY SYSTEMS

D.P. MCNUTT, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN920018)

Measure naturally occurring infrared background radiations from stellar, solar, and terrestrial sources and evaluate the results to provide data for optimizing military infrared surveillance and intercept equipment. Develop sensor techniques including amplifiers using cooled solid-state technology. Investigate systems for satellite-borne infrared detection of ships, aircraft and other satellites.

Prepare a map of the celestial sphere (100-300 microns) based on measurements to be made from a rocket. Develop threat warning and threat localization techniques for detection of jet aircraft and missiles at long distance (line-of-sight) and over the horizon by applying spectral modulation to detection of middle IR radiation. Carry out ground-based measurements (0.5-3mm) of the atmospheric emission of transmission spectrum under day and night conditions and under various weather conditions.

ADDENDA: Supporting agency address is: Naval Research Laboratory (7000), Washington, D.C. 20375

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0018, A NUMERICAL INVESTIGATION OF THE TIME-DEPENDENT CIRCULATION OF THE EASTERN AND EQUATORIAL PACIFIC

S.A. PIACSEK, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN680168)

To use monthly intends mean wind fields analyzed by Wyrtki to drive a two-layer hydrodynamic-thermodynamic numerical model of the upper equatorial and eastern Pacific Ocean. The aim is to simulate and understand the dynamics of the mean annual ocean circulation and to study important anomalous circulations including El Nino. The model will be used to forecast upper ocean layer environment from observational data, including satellites, and will fill an important gap in current Navy environmental forecasting capabilities.

The general approach will be to solve numerically the equations of hydrodynamics and thermodynamics relevant to the upper eastern and equatorial Pacific. The techniques employed (e.g. finite differences, stretched grids, etc.) will be tailored to this Pacific region for time scales from months to years. The variable coastline, bottom topography, stretched grids, vertical mixing, and solar isolation will be studied. A block-implicit relaxation technique is proposed to solve the implicit difference equations at each time step.

ADDENDA: Supporting agency address is: Office of Naval Research (481), Arlington, VA

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0019, ATMOSPHERIC, IONOSPHERIC AND MAGNETOSPHERIC PROCESSES AFFECTING COMMUNICATIONS AND SURVEILLANCE

E.P. SZUSZCZEWICZ, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN620160)

Understanding of processes in the near-earth environment (the magnetosphere, the ionosphere and the lower atmosphere) and their relationships to military personnel and systems. Current efforts address the serious degradation of transionospheric satellite communications (scintillations) at equatorial and high latitudes.

Experimental aspects involve in situ investigations with rockets and satellites as well as complementary laboratory studies the techniques of ion mass spectrometry, electric probes, UV photometry and spectroscopy are employed to determine a comprehensive information profile on the charged particle population in near-earth environment.

ADDENDA: Supporting agency address is: Naval Research Laboratory (7000), Washington, D.C. 20375

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0020, RESEARCH ON ATMOSPHERIC ELECTRICITY AND THE PREDICTION, AVOIDANCE, AND POTENTIAL MODIFICATION OF ITS ELECTRICAL HAZARD

J.C. WILLETT, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN520099)

Provide new and improved capabilities to the Navy in its military functions of predicting and/or modifying atmospheric conditions which produce electrical hazards, severe weather,fog, and clear air turbulence. This is achieved by studying the interrelation of atmospheric electric variables with meteorological processes.

Three interacting approaches are used (1) theoretical modeling; (2) laboratory experiments; and (3) field experiments including those carried out aboard aircraft and ships. Correlations between turbulance and electrical observations are used both to characterize the state of turbulance and to evaluate the physical linkages between charged particles and the wind field. Spectral analysis of electromagnetic impulses produced by lightning is used to identify storm areas and to study the propagation of these impulses.

ADDENDA: Supporting agency address is: Naval Research Laboratory (8000), Washington, D.C. 20375

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0021, NAVY ENVIRONMENT - TRANSIENT PROCESSES IN OCEAN CURRENTS

W. DUING, Univ. of Miami, School of Marine & Atm. Sci., *Miami, Florida* 33124 (DN575081; N00014-75-C-0173)

Increased knowledge is essential of the spatial and temporal variability of oceanic current systems if the Navy is to improve its ASW capability. These current systems induce sound refraction effects which not only effect ASW operations but such other missions as search and rescue.

An analysis is being made of transient processes of the Gulf Stream and Florida current based on data collected in early 1975 by the Defense Meteorological Satellite Program (DMSP). An analysis of the Atlantic equatorial undercurrent will be made in conjunction with data collected by the GARP Atlantic Tropical Experiment (GATE). The DMSP techniques will be extended to the Indian Ocean undercurrent and Somali current. This remote-sensing work should be a significant contribution to the study of large-scale circulation in the western Indian Ocean and will be conducted by the Indian Ocean Experiment (INDEX) program. The program will attempt to relate meteorological events and large-scale circulation in the Indian Ocean.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0022, THE STRATOSPHERIC WATER VAPOR SINK IN THE WINTER ANTARCTIC

J.L. STANFORD, Iowa State Univ. of Sc. & Tech, School of Hum. & Sciences, *Ames, Iowa* 50010 (ATM76-15403)

The processes by which water vapor is removed from the stratosphere are not well-understood. The most promising candidate among these processes is a mechanism operating in the winter antarctic. However, the magnitude of this antarctic sink is in doubt by at least a factor of ten.

This research will utilize satellite-derived temperature information for the southern polar stratosphere in winter. These data will be used to calculate the maximum (saturation) amounts of water vapor which can be held by the cold stratospheric air, as a function of pressure (altitude), geographical position, and time. The difference between these amounts and the generally accepted value for stratospheric water vapor content will be calculated and assumed to form precipitation particles. The stratospheric water mass removed is the total mass of these particles which are able to fall out of the stratosphere before evaporating in the warming air at the end of winter.

A second phase will refine the calculations by incorporating the effects of air circulation into and around the strong polar-night vortex and the effects of asymmetry of the cold air masses around the South Pole. A third phase of the research will utilize satellite radiance data from several years to determine the year-to-year variability of the stratospheric temperature structure in winter, allowing an estimate of the amount of water removed from the stratosphere during an 'average' year.

SUPPORTED BY U.S. Natl. Science Foundation

5.0023, NAVY ENVIRONMENT - ACOUSTIC SOUNDING OF THE MESOSCALE STRUCTURE OF THE SEA BREEZE

S.A. HSU, Louisiana State Univ. Systems, Coastal Studies Institute, *Baton Rouge, Louisiana* 70803 (DN575175; N00014-75-C-0192)

The objective here is to investigate the mesoscale structure of the sea breeze system using acoustic echo sounders. The thermodynamic aspects associated with cloud distributions over coastal areas is not at all well-known, and without these low-level boundary-layer observations, predictions of mesoscale motions in coastal areas is speculation. Successful Navy-Marine Corps reconnaissance-surveillance missions in coastal areas are directly related to local meteorological conditions and their pre-flight predictions.

Two acoustic radars and other radiosonde and meteorological instruments at the Eglin AFB towers will be utilized. Concurrent satellite cloud cover data will be integrated during the experiment, relationships will be correlated, and a mesoscale atmospheric predictive model formulation will be initiated.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0024, SATELLITE ALTIMETRY

B. CHOVITZ, U.S. Dept. of Commerce, Geodetic Res. & Dev. Lab., *Rockville, Maryland* 20852 (836910A3)

Measurements of altitude to the ocean surface from a satellite will provide, in the first approximation, information on the shape of the geoid (assuming that sea level corresponds to the geoid), and in the second approximation, information on tides, currents, salinity, and sea state which are deviations of sea level from an equipotential surface. The first use of satellite altimetry will therefore be geodetic and serve as a basis for the later oceanographic applications. The altimetry will provide direct dense measurements of geoidal heights on a global scale not possible by any other means. It will also aid in improving the figure of the earth as a whole in combination with other data.

Technical objective is to carry out analyses and provide computer programs in anticipation of data to be received from satellite altimetry. These programs not only handle altimetry but provide a precise ephemeris of the satellite, which is required to exploit the precision of the altimetry.

Task is of ongoing nature. It is anticipated that a continuously improving flow of data from successive NASA satellites will be forthcoming through this decade. Technical reports of progress will be issued when significant results have been achieved.

ADDENDA: This project is also supported by: National Aeronautics and Space Administration.

SUPPORTED BY U.S. Dept. of Commerce - N.O.A.A.

5.0025, GEODYNAMICS

B. CHOVITZ, U.S. Dept. of Commerce, Geodetic Res. & Dev. Lab., *Rockville, Maryland* 20852 (836910D0)

In line with a Principal NOS Goal for providing nationwide geodetic control reference points, and the approved objectives of strengthening and adjusting the horizontal and vertical control networks, it is important to be able to obtain extremely accurate supercontrol points closely monitored for temporal variations in positions as a long-range foundation for these expensive adjustments.

These control points can be provided for by new advanced means of observations. The principal methods being considered are radio interferometry, lunar laser ranging, and laser ranging to satellites (in particular the LAGEOS satellite, launched in May, 1976).

The methods mentioned also have the potential for obtaining polar motion and variations in earth rotation much more accurately, promptly, and efficiently than our present operational procedures.

Another potential capability of the interferometry method is the possibility of being applicable to conventional first-order field survey work.

The milestones outlined for accomplishing the objective are: choosing which methods are to employed and to what extent in 1976-77; carrying out preliminary experiments on selected methods in 1977-78, and carrying out an operational-type experiment in 1978-79.

SUPPORTED BY U.S. Dept. of Commerce - N.O.A.A.

5.0026, REMOTE-SENSING TWENTY YEARS OF CHANGE IN THE HUMAN ENVIRONMENT IN MASSACHUSETTS, 1951-1971

W.P. MACCONNELL, Univ. of Massachusetts, Agric. Experiment Station, *Amherst, Massachusetts* 01002 (0059477; MAS00013)

OBJECTIVE: Use remote-sensing techniques to monitor forest and other environmental changes in Massachusetts from 1951-1971. The maps prepared from 1971 aerial photography will provide ground truth for training in interpretation of Earth Resources Technology Satellite (ERTS) imagery.

APPROACH: Develop and test the use of aerial photogrammetric techniques as a tool for identifying and classifying agricultural, forest and wet lands; mining and waste disposal areas, as well as urban land and outdoor recreation sites. Determine changes in vegetation and land use which have taken place since the state was photographed and mapped in 1951 and 1952 by a similar system 1,2,3. Establish predictions of future rates and patterns of change for major land-use types based on changes over the past 20 years. Population growth and construction of transportation facilities will be used to help predict future change. Provide vegetative cover and land-use maps of the entire state for watershed managers, foresters, wildlife biologists, resource planners and others interested in the environment. Study urban growth and decay, especially the situation in the urban-agriculture or urban- forest interface in Massachusetts.

PROGRESS: Vegetation and land use maps at a scale of 1:24,000 have been prepared for the states of Massachusetts and Rhode Island. Area statistics of land-use types for towns, counties and states have been prepared. Bulletins have been prepared for Rhode Island and for all the Massachusetts counties. In Massachusetts land-use change for the period 1951/52 to 1971/72 have been determined and changes for the period 1971/72 to 1991/92 have been predicted. A special study of land-use change in the coastal zone of Massachusetts has been conducted in cooperation with the Coastal Zone Management agency. A special study of the effect of land use change on water production on 42 major watersheds in Massachusetts is nearly completed. A special study of agricultural change in Massachusetts is now being made. These land-use change studies have proven of interest to many agencies and individuals.

SUPPORTED BY U.S. Dept. of Agriculture - C.S.R.S.

5.0027, TROPICAL CYCLONE FORECASTING
F. SANDERS, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139 (DF243350; F19628-75-C-0059)

AF function - typhoon analysis and prediction. Deficiency or opportunity - inadequate data to make reliable typhoon forecasts. Objective - evaluate the use of satellite deduced winds in prediction models. How development contributes - establishes whether routine observations can improve tropical storm forecasting. Approach - the SANBAR model shows promise of being a very useful tool for forecasting tropical storm motion. It relies on information derived from wind soundings. Much of this information must be estimated because of an insufficient data network over the oceans. The motion of clouds from frame to frame in geosynchronous satellite pictures can be used to infer winds at the cloud levels. The MCIDAS system at AFCRL will be used to generate such winds. The contractor will first determine if the cloud motions at several levels in the atmosphere can be used to simulate the observed mean wind in the troposphere and, if so, the degree of improvement in the forecasts resulting from the substitution of satellite-deduced winds in the SANBAR forecast model. The one problem that may develop is getting sufficient storm data in the proper format during the short term of the contract.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory LY, L. G. Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0028, WATER VAPOR--ITS ROLE IN ATMOSPHERIC ENERGETICS AND CLIMATE, AND APPLICATIONS TO HYDROLOGY
M.F. WU, Environmental Res. & Tec. Inc., *Concord, Massachusetts* 01742 (ATM75-19625 A01)

This program of study seeks to identify both the long-term mean state of certain basic fields involving atmospheric water vapor content as well as fluctuations in these fields relevant to questions concerning climate change. An extensive set of observations will be used in the study, consisting of surface and upper-air soundings of winds, temperature and humidity taken at hundreds of stations around the globe during the fifteen-year period of May, 1968 through April, 1973. The natural variability in water vapor transport fields can be assessed through analyses of year-to-year changes employing a fairly lengthy record of recent atmospheric behavior.

Water vapor plays an important role in the energetics of the atmosphere, but few quantitative studies, of the scope proposed here, have been performed to date. As a result of these studies, the investigators expect to obtain a more accurate picture of the atmospheric energy balance and a better understanding of the magnitudes involved in climatic changes. In addition to studying quantities involving water vapor, the investigators plan to continue the studies of long-term trends of other parameters that help define the climatic state of the atmosphere. Such parameters include hemispheric mean temperature and other parameters relevant to the balances of angular momentum and zonal kinetic energy.

SUPPORTED BY U.S. Natl. Science Foundation

5.0029, WATERSHED VALUES AS AFFECTED BY FOREST MANAGEMENT
K.N. BROOKS, Univ. of Minnesota, School of Forestry, *Minneapolis, Minnesota* 55101 (100885 (HRB NO.))

The effect of vegetation and forest cover on the components of the hydrologic cycle of upland and peatland watersheds is being studied. Effects of alternative forest management systems on runoff, snowmelt, nutrient cycling, infiltration, energy regimes, and water quality parameters are being investigated in both the field and laboratory. Predictive equations and models are being developed in conjunction with field and laboratory experiments. Remote-sensing techniques to evaluate hydrologic components and water-quality status and trends are being utilized.

ADDENDA: Document provided to S.S.I.E. By the H.R.I.S.

SUPPORTED BY Minnesota State Government - St. Paul

5.0030, PHYSIOGRAPHIC CLASSIFICATION OF SOUTHERN PINE FOREST LANDS
W.F. MILLER, Mississippi St. University, Agric. Experiment Station, *Mississippi State, Mississippi* 39762 (0060698; MIS-0606)

OBJECTIVE: Organize physiographic land patterns into a system having significance and utility for resource managers. Develop a physiographic map of southern region using the new system.

APPROACH: Current information on physiography, soils, and surface geology related to forest vegetation will be analyzed and coordinated. Localized information will be reorganized to form a unified regional system. Map development will be on a state basis, utilizing local authorities, aerial photography, and space imagery when appropriate.

PROGRESS: Physiographic mapping of Alabama and Mississippi has been completed. Data have been obtained for all of the coastal states from South Carolina to Louisana plus Oklahoma, and mapping from the satellite imagery is in progress. Although Auburn University is largely responsible for this project, MAFES is cooperating through consultation and acquisition of additional satellite imagery. It is anticipated that a satellite mosaic of the habitat regions in Alabama and Mississippi, entitled 'Forest Habitat Regions from Satellite Imagery: States of Alabama and Mississippi' will be published at a scale of 1:1,000,000 by 1 January, 1976. A detailed legend will be printed on the reverse side of the map. 5000 copies are in the process of being printed.

SUPPORTED BY U.S. Dept. of Agriculture - C.S.R.S.

5.0031, ENERGY INTERACTIONS IN MESOSCALE SYSTEMS
G.L. DARKOW, Univ. of Missouri, Agric. Experiment Station, *Columbia, Missouri* 65201 (0057261; MO-00312)

OBJECTIVE: Observe and analyze the flow and thermodynamic interactions of mesoscale-convective storm systems and the larger-scale atmospheric systems which sustain them. It is anticipated that this observation and analysis will yield an improved understanding of the life cycle of severe convective systems, which in turn will yield improved forecast and warning techniques.

APPROACH: Selected surface, upper air, radar and satellite data from the archives of the National Climatic Center, the National Severe Storm Lab., the National Center for Atmospheric Research and the forthcoming Project SESAME will be locally processed, combined, and analyzed using mesoscale-numerical analysis methods developed at this institution.

PROGRESS: Progress has been made in two areas related to mesoscale systems and their severe local storm byproducts. An analysis of the hourly surface static energy fields associated with the massive severe storm outbreak of 3 April 1974 was completed. It was found that the spatial variations in the surface static energy field resolvable from conventional hourly airways teletype reports were intimately associated with the location and timing of the severe storm activity on this, the greatest severe storm outbreak of this century. The case study demonstrates the operational applicability of hourly surface static energy analysis as an additional severe storm forecast tool. The vertical wind profiles in the expanded tornado proximity sounding collection were reanalyzed in terms of motion components with respect to the moving, tornado-bearing storms. This resolution into relative winds disclosed a number of features of the environmental flow common to a majority of tornado-bearing storms regardless of their direction and speed of movement. These features tended to be masked, distorted and in some cases entirely lost during previous averaging attempts using actual winds rather than relative winds. Significant differences in the relative flow of the environmental winds were found for the class of severe storms known as right- or left-moving storms. Existing conceptual models of the flow regimes into and around quasi-steady-state severe storms will have to be revised in light of these findings.

SUPPORTED BY U.S. Dept. of Agriculture - C.S.R.S.

5.0032, ROLE OF TURBULENT BUOYANT PLUMES IN ATMOSPHERIC PROCESSES

W.K. GEORGE, State University of New York, Graduate School, *Buffalo, New York* 14222 (ATM76-01257)

There is considerable evidence that convection generated by isolated sources plays an extensive role in many atmospheric processes. Previous workers have shown the relationships between laboratory- generated thermals and the formation and dynamics of cumulus clouds and have used plume and thermal models to describe atmospheric boundary- layer phenomena. In spite of the success of simple models, very little is known about the dynamics of the turbulence in even simple plume and thermal flows. Of the three candidates for laboratory research on natural convection from isolated sources - plumes, thermals and starting plumes - only the plume is stationary in time and is easily studied. The objective of this research is to make a detailed experimental study of the turbulent energy balance and eddy structure of two- and three- dimensional plumes. The measurements will be carried out in hot airflows using multiple hot wire probes. The outputs from temperature- and velocity-sensitive wires will be simultaneously sampled by a high- speed analog to digital converter. Turbulence statistics will be obtained from the data. Determinations will be made of the entire turbulent energy balance. Spectral and correlation measurements of the temperature and velocity fields will be made to determine the turbulent eddy structure and its evolution. The information obtained in this investigation will be of considerable value to the further development of computational and conceptual models for turbulence in the atmosphere.

SUPPORTED BY U.S. Natl. Science Foundation

5.0033, FOREST MICROCLIMATE AND ENERGY EXCHANGE PROCESSES 12196-GS

K.R. KNOERR, Duke University, School of For. & Env. Studies, *Durham, North Carolina* 27706 (DA0D9241; DAAG29 74 G0086)

Models depicting forest meteorological processes have been formulated which provide predictions which currently are the best estimates of the exchange of energy and mass and of the vertical profiles of the environmental parameters which characterize the microclimate within the vegetative canopy. The purpose of this proposal is to obtain the use of additional instrumentation for some of the current and future experiments to test and improve the models. This proposal is concerned with environmental conditions in forest areas which affect a number of military activities including sensing and detection, communications, diffusion and transport of gases and pollutants, deterioration of materiel, acclimatization of the soldier, and operation of helicopters. The study is directly relevant to the high-priority program of the ECOM, Atmospheric Sciences Laboratory for development of an automatic meteorological systems to support the field Army. It also ties in well with an engineer topographic laboratory study of micrometeorological conditions in a Thailand forest.

Experiments include the thinning of forest vegetation at a current site. Two sets of micrometeorolgical instrumentation will be used for measurements in an unthinned (reference) stand and in the thinned stand.

ADDENDA: Supporting agency address is: DARCOM Army Research Office, Durham, NC 27706

SUPPORTED BY U.S. Dept. of Defense - Army

5.0034, NAVY ENVIRONMENT - OPTICAL MOTION CONTROL

L. EATON, General Electric Company, *Philadelphia, Pennsylvania* 19101 (DN675695; N00014-76-C-1057)

The objective of this research is to provide a means of manipulation and movement of droplets in a cloud physics chamber under conditions of zero gravity, earth gravity, and variable gravity. The manipulative technique is mainly for use aboard the Space Shuttle Cloud Physics Laboratory, use of which can effect economies in the Navy Cloud Physics Program aimed at improvement of the weather forecast and fog dissipation.

A beam of guided radiation with a Gaussian mode front will be used to contain and guide water drops and other hydrometers in a variety of cloud physics studies, such as nucleation of drops by freezing nuclei, coalescence of drops, growth of ice crystals, etc. The study will be both theoretical and experimental and eventually will lead to the design of the manipulation technique for the Cloud Physics Laboratory of the Space Shuttle.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0035, ESTIMATION OF SHORT-WAVE AND LONG-WAVE RADIATION FOR CLIMATIC MODELS

H.A. PANOFSKY, Penn. State University, School of Earth & Min. Sci., *University Park, Pennsylvania* 16802 (8-414; 04-6-158-44013 MOD. NO.3)

The object of the research is to provide statistical techniques from which albedo and infrared radiation escaping into space can be estimated as function of variables normally available in numerical climatic models. The techniques will be based on statistical analysis of conventional and satellite data. Statistical relations will be sought between long- and short-wave radiation, as estimated from satellites and hydrodynamic data such as stability, humidity, vertical velocity, etc. Based on these relations, multiple-regression equations can be developed for the estimation of infrared radiation and atmospheric reflectivity directly from the hydrodynamic variables. The plan calls for examination of a summer period over land and the establishing of statistical relations for the prediction of the outgoing long-wave radiation and albedo. In addition, a preliminary examination of the development of ocean models will be undertaken and a statistical model for the prediction of the zonally averaged albedo and infrared radiances over land will be developed.

PROGRESS: To date, equations based on predictors from the National Meteorological Center's (NMC) Limited Fine Mesh (LFM) numerical grid point model have been developed for the separate predictands, 'window radiance' and short-wave albedo, valid at the top of the atmosphere at normal incidence. Results from a series of experiments show that on the independent sample of data, 65% of the variance can be explained and that more density can be accounted for by the regression model. Long- wave radiation predictors are a modified Planck function, the maximum relative humidity in a layer, the 500mb wind speed, the height change, a jetstream cirrus cloud variable, and a southerly flow variable. A categorical method is used to predict albedo. So far nearly 60% of the variance can be accounted for, however better snow and cloud/no cloud identification should make improvements. Experiments on prediction of zonally averaged infrared radiances over land rather than radiances at grid points are being undertaken because of their importance for climate models.

SUPPORTED BY U.S. Dept. of Commerce - N.O.A.A.

5.0036, ATMOSPHERIC INFLUENCES ON ECOSYSTEMS AND SATELLITE SENSING

J.W. ROUSE, Texas A & M University System, Agric. Experiment Station, *College Station, Texas* 77843 (0058507; TEX02696)

OBJECTIVE: Develop methods for evaluation and utilization of remotely sensed data pertaining to agricultural ecosystems from ERTS and aircraft.

APPROACH: Test sites will be established near the Lubbock and Weslaco Agricultural Research Center. Considerable aircraft sensor data is presently available at Weslaco. Similar data can likely be obtained for the Lubbock site through the NASA Earth Resources Aircraft Program. These data, and supporting 'ground truth' will provide the baseline for the NE-69 effort. Subsequent comparison with ERTS data will establish the value of satellite data to each of several Texas agricultural management programs.

PROGRESS: The ongoing plant disease and rangeland species projects have included spectral reflectance measurements using the NASA Field Signature Acquisition System and LANDSAT band reflectance measurements via an Exotech LANDSAT radiometer. Foliar diseases of peanuts have been monitored and moisture and nutrient stress in St. Augustine grass have been examined. In addition, wheat and rangeland measurements have also been acquired by ground-based radiometers as well as by LANDSAT. A microwave project for monitoring of soil moisture was conducted with measurement of an increased number of surface roughness conditions. The field measurements were conducted with a ground-based two-frequency (L- band and X-band)

microwave radiometer. A project is being conducted as a continuation of the LANDSAT-1 Great Plains Corridor Rangeland project. The emphasis of this project is on the regional expansion of natural vegetation system monitoring techniques developed under the previous project.

SUPPORTED BY U.S. Dept. of Agriculture - C.S.R.S.

5.0037, ANALYSIS OF AURORAL DATA OBTAINED BY SOUNDING ROCKETS AND GROUND-BASED OBSERVATORIES

H.R. ANDERSON, Rice University, Graduate School, *Houston, Texas* 77001 (ATM75-22871)

This grant will support a joint project between the University of Washington and Rice University for the further analysis of data obtained in a Rice University program of auroral observations using sounding rockets. These data will be used as input for model calculations designed to investigate the following areas of current interest in auroral observations and theory: 1) Auroral electron backscatter and predictions based on scattering theory both with and without electric fields. 2) Comparison of observed pitch-angle and energy variations in the particle fluxes with model calculations of pitch-angle and energy variations caused by electric fields parallel to the magnetic field and/or other acceleration mechanisms. 3) Comparison of vector magnetometer data with perturbations predicted by model calculations of current systems associated with auroral arcs. 4) Comparison of variations of particle flux in the 0-10 Hz range with optical intensity variations in this frequency range observed using the University of Alaska auroral television system. 5) Analysis of data obtained by Chatanika radar in support of rocket flights. 6) Comparison of measured auroral photon emission with that calculated to result from the measured charged-particle flux.

The overall objective is to understand auroral particle precipitation and its energy sources. The collaboration using many different ground-based instruments makes this grant relevant to the aims of the International Magnetospheric Study.

SUPPORTED BY U.S. Natl. Science Foundation

5.0038, REMOTE SENSING FOR SPECTRAL ANALYSIS OF SOIL AND WATER CONDITIONS AND PROBLEMS

C.L. WIEGAND, U.S. Dept. of Agriculture, Soil & Water Cons. Res. Div., *Weslaco, Texas* 78596 (0040968; 7202-12370-001)

OBJECTIVE: Develop fundamental information on the reflectance and emission characteristics of plants and soils, and test small data batches from electronic and optical mechanical systems aboard aircraft and spacecraft for detecting and assessing agricultural problem conditions.

APPROACH: Analyze seasonal changes of crops, discriminate among them, and estimate the acreages of selected crops in Hidalgo County using the Earth Resources Technology Satellite (ERTS) 4-channel scanner digital magnetic tape data. Determine whether differences in chlorophyll concentration in grain sorghum can be detected in ERTS data. Compare ERTS near-infrared reflectance with ground observations of leaf area index (LAI) and with predictions of an analytical model for determining plant vigor (cropland) and animal carrying capacity (rangeland). Complete study on optimal film types for soil mapping. Determine the influence of leaf maturation on reflectance of radiation over the 2.5- to 40-mum wavelength interval. Investigate procedures required to map saline soils by use of SKYLAB multispectral and photographic data.

PROGRESS: Reflectance measurements confirm that remote sensing with photography is useful for distinguishing among early infestations by citrus blackfly, brown soft scale, and citrus mealybug insects. Multispectral scanning at the 3.0- to 9.5-mum wavelengths may be useful to remotely identify certain plant species. Nematode- and water- stressed leaves had less near-infrared light reflectance and more compact mesophylls than non-stressed leaves. Thick epidermises give more protection against ultraviolet-radiation damage to inner leaf structures than thin epidermises. Cenizo leaves had higher visible and near-infrared light reflectance than honey mesquite leaves; this difference should be useful to remotely distinguish between them on rangelands. LANDSAT results may be useful to relate crop residues to wind and water erosion susceptibility of soils, and it can be used in Hidaigo County, TX to characterize leading crops, inventory major land uses, and identify chlorotic sorghum areas larger than 2.8 acres. Color prints can be used by the Soil Conservation Service to increase the rate of soil survey mapping compared to using black-and-white prints with a salary-saving of about two cents per.

SUPPORTED BY U.S. Dept. of Agriculture - A.R.S. - S.T.A

5.0039, THE LATITUDINAL DISTRIBUTION OF IONOSPHERIC ABSORPTION

H.J. CHIVERS, Utah State University, Graduate School, *Logan, Utah* 84321 (ATM76-17762)

This grant will support a program of analysis of the data from the latitudinal chain of riometers to be operated in Alaska during the period of the International Magnetospheric Study (IMS). This network of stations already exists in a primitive form and is about to be expanded to higher latitudes with improved instrumentation so that high-quality digital records will be obtained. Since the new riometers which will be used will have a fast response time, emphasis will be placed on the analysis of the fine structure of auroral absorption events. Recent studies of absorption events recorded with the Alaskan chain have shown that there are probably two significant components to each absorption event. These components tend to move at different velocities in the latitudinal direction, and, in fact, the components have been observed to move in opposite directions. These movements can be related to corresponding movements in the magnetosphere following solar disturbances and the movements have been used to derive a value for the electric field of the magnetosphere. The main result expected will be to show to what extent the short period variations of absorption take part in the complex latitudinal motion of absorption. In addition, a class of fast isolated events associated with relativistic electron precipitation has been identified, and these can be used in conjunction with observations using the Chatanika radar facility to investigate magnetosphere dynamics. This award represents a small but important part of the coordinated activities to be performed under the IMS.

SUPPORTED BY U.S. Natl. Science Foundation

5.0040, RESEARCH IN REMOTE SENSING

J.N. RINKER, U.S. Army, Res. Inst., *Fort Belvoir, Virginia* 22060 (DA0L8051)

The objectives are: (1) to develop fundamental theories, hypotheses and relationships between terrain factors and photographic characteristics; (2) to develop and define criteria for interpreting terrain factors from photography; (3) to determine deficiencies of existing collection sensors or interpretation techniques; and (4) to define a research program to overcome these dificiencies.

Determine, define and document the required terrain information in terms of identity, nomenclature and specifications. Prepare matrices depicting the required information and the interpretation capabilities indicating the information which can be obtained and that which cannot. Define deficiencies of the sensors and interpretation techniques. Develop a research plan encompassing interdisciplinary team analysis of imagery in the laboratory, coordinated air/ground sampling in selected environments where necessary, and close support spectral analysis of selected terrain parameters at the local field research area under controlled conditions.

ADDENDA: Supporting agency address is: OCE ETL Research Institute, Ft. Belvoir, VA 22060

SUPPORTED BY U.S. Dept. of Defense - Army

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, AIRCREW PROTECTIVE CLOTHING AND DEVICES

W. SHAW, U.S. Navy, Natl. Parachute Test Range, *El Centro, California* 92243 (DN937031)

Sub-task 01: to determine operational suitability of aircrew protective clothing and devices. Sub-task 02: to determine compatibility of personnel detection, survival and rescue systems/devices with in- flight escape systems and with parachute recovery systems. Sub-task 03: to develop and upgrade, test and evaluate recovery system hardware components.

Sub-tasks 01 and 02: specific test programs will be designed and conducted to satisfy operational requirements. Sub-task 03: review existing designs in light of needs; develop and/or contract for test items; test, finalize design, compile data package.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D. C. 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0002, LEVEL OF ALERTNESS AND THE PERCEPTUAL PROCESSING OF VISUALLY DISPLAYED INFORMATION DURING SIMULATED FLYING MISSIONS

E.H. GALLUSCIO, U.S. Air Force, Frank J. Seiler Res. Lab., *Colorado Springs, Colorado* 80840 (DF281910)

AF function - to identify through literature search and study the effective visual information processing during simulated flying which are most influenced by fluctuations in level of alertness. To develop research protocol which will examine psychological and physical stresses which degrade these facets of visual information processing. Deficiency - aircraft losses due to loss of alertness. How research contributes - provides vital data on factors affecting alertness. Abstract - simulated flying missions of varying complexity will be performed while arousal level would be manipulated via fatigue, ambient noise levels, and/or psychological stresses. Patterns of visual search will be monitored to determine how scanning and attention to relevant and irrelevant sources of information are affected.

ADDENDA: Supporting agency address is: Frank J Seiler Research Lab NC, USAF Academy, Colo 80840

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0003, APPLICATION OF INSTRUCTIONAL SYSTEMS DEVELOPMENT

R.G. BIRD, U.S. Navy, Human Factors Laboratory, *Orlando, Florida* 32813 (DN594000)

To develop a method for applying the systems approach to training to the development of Navy aircraft systems, and to test this method on a number of operational systems.

The program will be accomplished through the application of the ISD process to the pilot and tactical positions of the A-6E TRAM, EA-6B ICAP, SH-2F LAMPS and E-2C aircraft. The effort will be divided into two phases. Phase I will be directed to the specification and description of the course content, instructional strategies, and training devices that will provide an optimum training program for each aircraft. This will be accomplished through analyses of performance requirements and media techniques and the development of course content and organization. Phase II will be concerned with the actual production of instructional materials, syllabi, and devices followed by the implementation of all or parts of the programs in selected squadrons. Phase II will end with the evaluation of each program and recommendations for subsequent update and improvement.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Research and Technology, Washington, D. C. 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0004, INSTRUCTOR PILOT'S ROLE IN SIMULATOR TRAINING

V.J. SHARKEY, U.S. Navy, Human Factors Laboratory, *Orlando, Florida* 32813 (DN494046)

The objectives of this effort are to define the role of the instructor pilot in simulator training, to determine the feasibility of developing training for instructor pilots and to specify the design of the instructor station for use by instructor pilots and training device personnel.

The effort will consist of the following: (a) review prior and current research and development relevant to the design and use of instructor consoles with particular emphasis on instructor stations for OFT's, (b) specify pilot instructor training goals in OFT utilization, (c) develop a candidate design for an instructor pilot console based on the above specifications, (d) carry out a series of experiments in the simulation facilities, to specify the final design of an instructor pilot console for use with an OFT, and (e) demonstrate the feasibility of using the console as an instructor pilot training device.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Human Factors Lab, Washington, D. C. 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0005, EVALUATION OF THE EFFECTS OF TASK INTERFERENCE AND SHIFTING TASK PRIORITIES ON PERFORMANCE

R.S. GIBSON, U.S. Navy, Aerospace Medical Res. Lab., *Pensacola, Florida* 32512 (DN766228)

Changes in cockpit task structure resulting from advances in aircraft technology continually increase the premium on a flight crew's ability to manage information and make rapid decisions while controlling basic flight and navigation functions. Valid techniques are needed for the measurement of such time-shared performances and for their prediction. Performance efficiency can be affected by the difficulty of each individual task, the degree of interference among concurrently performed tasks, shifting individual task demands dictated by mission priorities, and the operator's individual capabilities. The objective of this research is to investigate the relationships among these factors and their implications for system design and aircrew performance.

This investigation will employ a set of automated performance tasks to provide comparative estimates of operator capacity in single-task and multi-task situations. The technique involves manipulations of sub-task demands and measurement of an individual's multi-task capacity relative to his performances on the sub-tasks performed singly. The rationale assumes that maximum performance estimates for individual sub-tasks can be obtained in a short test period and that subsequent performance improvement on each will be small during a single session, thus providing bases for controlled estimates of the effects of task interference and shifting task priorities on performance. While this research will be part of a larger coordinated effort supported by a BUMED 6.2 1498, it has an independent developmental background and its own specific objectives. The principal tasks will represent an initial effort to combine and assess a set of tasks developed at the University of Illinois' Institute for Aviation with complex performance tasks developed under the BUMED 6.2 effort. In addition, this work unit will initiate work directly concerned with the effects of assigned task priorities and their interactions.

ADDENDA: Supporting agency address is: Naval Aerospace Medical Research Lab, Pensacola, FL 32512

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0006, PREDICTIVE MODELS OF HUMAN VISUAL PROCESSES IN AEROSYSTEMS

R.J. MANSFIELD, Harvard University, School of Arts & Sciences, *Cambridge, Massachusetts* 02138 (DF044250; F44620-76-C-0109)

AF function - in Air Force flight operations target-acquisition activities, optical countermeasures, display scanning, reconnaissance photointerpretation and other activities are critical for mission success. In all of these activities man's visual processes are of vital importance. Deficiency - research is needed to specify the visual performance characteristics of man in terms compatible with evolving, complex man-machine systems. Present models of human visual processes have limited value for enhancing human visual performance during critical Air Force missions. Objective - the principal goals of the proposed research are to (1) analyze the functional capacities of human observers to detect, discriminate and evaluate visual patterns, and (2) synthesize experimental data in terms of a mathematical model of the human visual system that is both predictive of performance and consistent with known physiological mechanisms. How research con-

tributes - the proposed research will permit the comprehensive determination of a wide range of visual parameters, and the models for human visual processes critical to Air Force missions will be extended.

The experimental approach will employ interactive computer control of both a visual simulator that will include a visual display generator and a device for the precise and accurate tracking of eye movements.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NL, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0007, SYSTEMS APPROACH TO TRAINING (E-2C)
R.C. SUGARMAN, Calspan Corporation, *Buffalo, New York* 14221 (DN594015; N61339-75-C-0101)

Develop procedures/models which will permit the deliberate and orderly planning of specific aircraft instructional programs necessary to ensure that personnel acquire the knowledge, skills, attitudes and behaviors essential for successful job performance in a specified aircraft. The models will include selection of the appropriate analyses necessary for performance parameter development and specification of training/behavioral objectives and will provide a basis for the selection of instructional material, methods, media, and equipment necessary for the development of an optimal, cost-effective curriculum.

Existing SAT methodology will be used to produce lesson specifications, media selection and analysis for each of the weapon systems. The program efforts will be limited to operator and tactical positions of the EA6B, E2C, and A6E weapons systems.

ADDENDA: Supporting agency address is: Naval Training Equipment Center, Human Factors Lab, Orlando, FL 32813

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0008, PERSONNEL TECHNOLOGY - THE EFFECTS OF NAVY HAZARDOUS ENVIRONMENTS UPON VISUAL TASKS
J.L. BROWN, Univ. of Rochester, School of Medicine & Dentistry, *Rochester, New York* 14642 (DN623811; N00014-76-C-0189)

Determination of the effects of varying degrees of illumination, from very low to high-intensity flash, on the effectiveness of visual information transmittal from naval aircraft and ship displays continues to be significant to accomplishment of the Navy's mission. This work unit is concerned with the study of aspects of pattern discrimination, color discrimination and visual acuity as they are relevant to the design and improvement of instruments for the visual display of information.

Planned research includes continuation of (1) psychophysical studies in man on the temporal and spatial resolution of the visual system, (2) electrophysiological studies in animals attempting to relate activity at various points in the visual system and cortical activity, and (3) development of an objective and rapid procedure for evaluating the presence and extent of color deficiency in humans.

ADDENDA: Supporting agency address is: Office of Naval Research 441, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0009, SENSATIONS OF MOVEMENT AND CHANGES OF PERCEIVED ATTITUDE IN DYNAMIC FLIGHT SIMULATION
M.M. COHEN, U.S. Navy, Crew Systems Department, *Warminster, Pennsylvania* 18974 (DN581102)

To determine thresholds and transfer functions describing human sensory responses to linear and angular accelerations. To determine how linear and angular accelerations interact to produce sensations such as those encountered in actual aircraft flight maneuvers. To employ the derived transfer functions in controlling the NavAirDevCen human centrifuge, enabling its extended application in research, development, evaluation and training.

Threshold and transfer functions for human sensory responses to combined linear and angular accelerations will be determined and used to control the NavAirDevCen human centrifuge as a dynamic flight simulator. Because simulators do not duplicate the precise accelerations and motions of aircraft maneuvers being simulated, it is necessary to substitute other motions and accelerations so that the pilot is minimally aware of any substitution. For an adequate substitution of accelerations to be achieved, it is imperative to understand now linear and angular accelerations are perceived by human observers and how they interact under a wide range of conditions. The proposed research will measure thresholds and transfer functions for human sensory responses to linear and angular accelerations, and will determine what tradeoffs can be made between linear and angular accelerations in dynamic flight simulation.

ADDENDA: Supporting agency address is: Naval Air Development Center, Warminster, Pennsylvania 18974

SUPPORTED BY U.S. Dept. of Defense - Navy

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, COMPUTING METHODS FOR THE APPROXIMATE SOLUTION OF TIME-DEPENDENT PROBLEMS
J.E. OLIGER, Stanford University, School of Hum. & Sciences, *Palo Alto, California* 94305 (DN575403; N00014-75-C-1132)

Many current computational problems lead to mathematical problems which are significantly different from those which have been studied in the past. Many of these problems arise from the use of modern measuring devices and systems such as those used on observational satellites. Variables that have been natural to consider as primary in the past are often impossible to measure with the new technology and vice versa. Similarly, the classical problem settings such as the Cauchy problem or usual initial-boundary value problem may not be directly applicable since the modern observing systems often provide information at different locations at different times instead of snapshots of the complete system at some given time. Such problems arise naturally in meteorology oceanography and geophysical prospecting. The mathematical problems associated with these applications have not often been investigated, and sound approximate methods for these problems cannot be developed without an understanding of the underlying equations in the appropriate setting. Similarly, limited area weather prediction and storm surge calculations are naturally approached as initial-boundary value problems. However, it is now known that some of the equations usually used are not well-posed when the usual, easily-measured quantities are used for boundary data. This obviously leads to a dilemma which requires attention. These examples illustrate an obvious need for thoughtful interaction of applied mathematics and the relevant applied sciences for these problems.

This research is to investigate computational methods for time dependent problems in a broad context which encompasses the scientific application for which they are needed, applied mathematics, numerical analysis and computer science.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

7.0002, GLOBAL NUMERICAL MODELING OF THE EARTH'S PLANETARY ATMOSPHERE
R.V. MADALA, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN680041)

To provide a comprehensive numerical modeling program geared to the advanced research and development phase of Navy atmospheric environmental forecasting. The models will be developed in collaboration with NPGS, EPRF, and FNWC. Once benchmarked, they will be transferred to appropriate Navy operational groups (e.g., FNWC, NEL, etc.).

The general approach will be to solve numerically the equations of hydrodynamics, thermodynamics, and photochemistry relevant to the various atmospheric regions and processes on large digital computers. The techniques employed (e.g., finite differences, spectral expansions, movable nested grids, etc.) will be specifically tailored to particular atmospheric phenomena or regions and associated initial and boundary conditions. Specific models will be developed for global and limited area domains; yet they will be required to be compatible, so that they can be run jointly in an interactive fashion.

ADDENDA: Supporting agency address is: Naval Air Systems Command (NAIR 370), Code 370, Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

7.0003, NUMERICAL SOLUTION OF ELLIPTIC PARABOLIC BOUNDARY VALUE PROBLEMS
I. BABUSKA, Univ. of Maryland, Inst. For Fluid Dyn. & Math., *College Park, Maryland* 20742 (E(40-1)-3443)

The goal of the project is to design and to understand theoretically the behavior of numerical procedures for solving partial differential equations which describe different complicated problems in applications and which lie outside the problem areas which have mathematically been studied. The main emphasis will be placed on dealing with problems where the solution is very unsmooth (occurring, e.g., in the theory of composite materials, reactor computations, theory of polymers, etc.), where the equations are of mixed type, etc. The problems under consideration will be transformed by different techniques to problems which lend themselves more readily to numerical analysis and their effects on computational efficiency will be a major consideration. Another goal is to develop a theoretical mathematical basis for a procedure in which the computer could make optimal decisions for obtaining numerical results which will lead to prescribed reliability of results obtained. This project is based on results and experience obtained during previous years. The main objective is theoretical mathematical analysis with numerical testing on typical model problems which will show the strength and weakness in the theoretical understanding of the approach and which will stimulate further developments.

RESULTS: The results in the proposed field have been obtained by the investigators and published in the form of various reports and publications.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

7.0004, AIR CUSHION VEHICLE (ACV) MATHEMATICAL MODEL DIGITAL COMPUTER PROGRAM
B. CUEVAS, Charles Stark Draper Lab. Inc., *Cambridge, Massachusetts* 02139 (DN594006; N61339-75-C-0057)

The development of a digital computer program for an ACV math model. The programmed ACV math model, a combined effort of the Draper Lab and NTEC Incorporated with the CRT display system will be used for training pilots in maneuvering into a mother ship and landing on a beach.

The effort includes: (1) designing a real-time simulation program for the ACV; (2) programming the equations of motion; (3) programming the vehicle generated wave resistance; (4) developing the software for the use of a CRT display; and (5) integrating the software developed by the Draper Laboratory.

ADDENDA: Supporting agency address is: Naval Training Equipment Center, Computer Lab, N214, Orlando, FL 32813

SUPPORTED BY U.S. Dept. of Defense - Navy

7.0005, NUMERICAL METHODS AND APPROXIMATION TECHNIQUES FOR FLUID DYNAMICS APPLICATIONS
G. BIRKHOFF, Harvard University, School of Arts & Sciences, *Cambridge, Massachusetts* 02138 (DN624163; N00014-75-C-0596)

The high-speed computer has provided Navy scientists and engineers with numerical answers to problems in fluid mechanics, structural mechanics, heat transfer, and nuclear reactor theory of such complexity as to be unsolvable sixteen years ago. The success of this contemporary work derives directly from research efforts of the type supported herein, since before programming and computation can be started, the kinds of analysis represented here must be undertaken. Problems of particular significance which have given rise to these techniques come from lubrication theory, boundary-layer theory from hydrodynamics and aerodynamics and transport theory for nuclear reactors.

Research is done on a group of related mathematical problems derived from fluid mechanics. Since emphasis is placed on the development of numerical techniques for engineering contexts, there is considerable work done on approximation theory and error analysis for digital computing algorithms.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

7.0006, VIRTUAL MACHINE STUDY
U. GAGLIARDI, Harvard University, School of Arts & Sciences, *Cambridge, Massachusetts* 02138 (DF727720; F30602-76-C-0001)

The objective of this effort is to explore technology in the area of virtual machine monitors (VMM) and the impact of virtual machine notions in the following areas: (1) The potential use of virtual machine notions as organizing principles for very reliable systems. (2) The use of VMM's as software tools to influence program development productivity. (3) The potential use of VMM's in meeting Air Force real- time operating system requirements. (4) The utilization of VMM's as a technique for the development of modular operating systems. (5) Firmware/software trade-offs in the design of VMM's.

The approach of this effort is to utilize a recognized center of expertise in virtual machine monitors and operating system located at Harvard University to perform research in the above areas.

ADDENDA: Supporting agency address is: Rome Air Development Center ISI, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

7.0007, DATA PROCESSING AND INTERFACE SUPPORT
P. SANYAL, Pattern Analysis Recog. Corp., *Rome, New York* 13440 (DF740080; F30602-75-C-0144)

To upgrade the available in-house experimental facilities at the Verona Test Annex, to meet specific optical measurement requirements on moving targets and to further develop data processing and analysis software that will result in providing needed experimental data in subject area.

Through the procurement of engineering services and materials, computer programs will be developed which are required to control the one meter optical beam director in tracking moving targets such as stellar sources, satellites and aircraft. In addition, special data processing and analysis software will be developed. Each will specifically be defined by the optical experiment.

ADDENDA: Supporting agency address is: Rome Air Development Center OCS, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, THEORETICAL RESEARCH ON THE ELECTRONIC PROPERTIES OF SOLIDS
L.M. FALICOV, Univ. of California, School of Letters & Science, *Berkeley, California* 94720 (DMR76-80561)

Theoretical investigations of the electronic properties of solids previously supported by NSF grant DMR72-02106 A02 will be continued. The electronic properties of stepped surfaces of metals, semimetals and semiconductors will be studied for clean surfaces and for surfaces with chemisorbed atoms or molecules. Other topics to be investigated theoretically include: the electronic properties of transition metal and rare earth metal com-

pounds; the electronic structure of inversion layers at semiconductor surfaces; the electronic, vibrational and magnetic properties of disordered systems; and the influence of uniaxial deformations on antiferromagnetism.

SUPPORTED BY U.S. Natl. Science Foundation

8.0002, THEORY OF ELEMENTARY PARTICLES
S. MANDELSTAM, Univ. of California, School of Letters & Science, *Berkeley, California* 94720 (PHY74-08175 A03)

Research will be carried out in a number of branches of particle theory. In dual models, it is hoped to apply to realistic models methods which have been developed for spontaneous symmetry breaking. It is planned to apply operator methods, already used in one-dimensional problems, to explore the relation between the dual string and the Nielsen-Olesen vortex, and to continue the work on quark confinement within this system. On the subject of gauge theories, an attempt is being made to eliminate the Higgs scalars in favor of a B.C.S. mechanism. The problem of pi-eta degeneracy is being studied further. It is also hoped to extend the models where electromagnetism appears as a consequence of strong interactions. Work will be continued on models of the psi meson which avoid difficulties of current models. Methods already proposed for treating the renormalization group, especially with regard to infrared problems, will be continued. With regard to the structure of von Neumann algebras, work already performed on the duality condition has led to problems which will be studied; possible implications for scattering theory may be interesting.

This work represents a continuation of that currently supported by Foundation grant PHY74-08175 AO1. Scientific summary same as for that grant.

SUPPORTED BY U.S. Natl. Science Foundation

8.0003, GENERATION OF HIGH-BETA PLASMAS AND DIAGNOSTICS
A.Y. WONG, Univ. of California, School of Letters & Science, *Los Angeles, California* 90024 (DF044880; F49620-76-C-0011)

AF function - operation of high-altitude vehicles in a post nuclear explosion environment, development of electromagnetic weapons, space and ionospheric communications as well as countermeasures demand fundamental understanding of the processes occurring in high-beta plasmas. Deficiency - the aforementioned information required to design advanced equipment is not available today. Its acquisition may be realized by the development of microwave holography and other sophisticated diagnostics. Objective - this project will investigate the fundamentals of generation of high beta plasmas and the development of advanced instrumentation techniques and equipment such as microwave holography. Contribution - this work is a part of a comprehensive program of plasma research for the development of an x-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and particle beams), the development of space and ionospheric communications, and the development of countermeasures.

This project will perform theoretical and experimental work toward the understanding of behavior of high beta plasmas. It will develop advanced instrumentation methods such as microwave holography. This technique will enable one to map the three-dimensional density distribution of a plasma without any solid disturbance. The techniques to be used are: (a) Inverse propagation which is similar to optical holography and measures the amplitude and phase of the microwave radiation field from a point source over a surface, thus permitting the reconstruction of the field in three dimensions in the intervening medium. (b) Microwave tomography, which maps out the complete density distribution rather than just the critical layers and other rapidly spatially varying features. The aforementioned diagnostics will be used in the experimental plasmas produced in the SURMAC. In addition, theoretical computer experiments will be performed by the theoretical group of Dr. Dawson to support the foregoing. During the magnetic compression experiments the behavior of alfven waves will be studied. These low frequency waves have important applications in space plasma communications and account for some of the magnetic and density disturbances occurring in space plasmas.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NP, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

8.0004, PHOTOTHERMOELECTRIC EFFECTS IN SEMICONDUCTORS
R.H. BUBE, Stanford University, School of Engineering, *Palo Alto, California* 94305 (DMR76-20037)

This research is aimed at applying the techniques and phenomena involved in thermoelectric and photothermoelectric effects in semiconductors to a variety of basic problems in thin films of polycrystalline and amorphous material. The purpose is to identify and characterize impurity and imperfection states, and transport processes in electronically significant materials.

Research on transport in thin films will include n-type doping of zinc sulfide, zinc selenide, cadmium selenide and cadmium telluride, and p-type doping of cadmium telluride and zinc telluride. Substrate temperature and growth rate profiling during deposition will be investigated in order to optimize structural and electrical properties. Thermoelectric power will be measured as a function of grain size, crystallographic film orientation, identity and orientation of the substrate, and doping.

Studies on transport in amorphous semiconductors will include measurements of thermoelectric power as a function of temperature for amorphous semiconductors, such as (AsxGe1-x)2Te3. In addition, measurements of dark conductivity, photoconductivity, and field effect will be undertaken to better understand the transport processes in such materials.

This is a renewal of NSF Grant DMR72-03256.

SUPPORTED BY U.S. Natl. Science Foundation

8.0005, DEVELOPMENT AND TESTING OF A SUPERCONDUCTING ELECTRON ACCELERATOR WITH RECIRCULATION OF THE BEAM, AND NUCLEAR PHYSICS EXPERIMENTATION
M.R. YEARIAN, Stanford University, School of Hum. & Sciences, *Palo Alto, California* 94305 (PHY76-80168)

Work will be continued on the study of the properties of superconducting niobium radio-frequency cavities, and on the study of their application to electron accelerators. A nuclear physics research program using such an accelerator will be initiated.

The superconducting cavities will be studied for performance under actual operating conditions in an accelerator, with special emphasis on electrical breakdown which limits the electric field gradients available for acceleration and on the phenomenon of electron multipacting which significantly affects the quality of the beams produced in the accelerator.

An accelerator development program will seek to provide high-energy electron beams by using four accelerator sections in series, each containing 55 cavities. To increase further the energy of the electrons, the beam will be recirculated one or more times through the basic accelerator. Energies in the 100 MeV to 200 MeV region are anticipated.

The electron beams produced will be used to conduct nuclear physics research, particularly in the excitation of giant nuclear resonances by inelastic electron scattering, with detection of the protons emitted in the decay of the excited nuclei. Such studies are possible only with the very high-quality beams produced in this type of accelerator, namely high energy, excellent energy resolution, very small phase space and very good duty factor, together with high intensity.

This work is a continuation of that currently supported by Foundation grant PHY73-08870 AO5.

SUPPORTED BY U.S. Natl. Science Foundation

8.0006, STUDY OF SEMICONDUCTOR STRUCTURES USING NUCLEAR TECHNIQUES
J.W. MAYER, Calif. Inst. of Technology, School of Engineering, *Pasadena, California* 91109 (DN475233; N00014-75-C-0564)

Development of new electronic devices and device fabrication techniques for Navy systems is dependent on better understanding and exploration of new concepts in solid-state electronic materials.

There are many reactions which can occur between metal-semiconductor and semiconductor-semiconductor structures. Many of the processes occurring at the interfaces can occur at relatively low temperatures termed solid phase reactions. A new rule has been suggested which predicts which compounds will be formed in metal-semiconductor binary couples. The investigator will test this rule in the formation of silicides and germanides. He will systematically investigate the composition of the layers formed from metal films deposited on crystalline semiconductors. A second part is concerned with the regrowth process which occurs in silicon and germanium single crystals which follows the damage processes in ion implantation. The regrowth kinetics, rates, dopant effects, etc., will be studied for electrically active impurities, and for isoelectronic elements. Facilities are being upgraded to allow a broader ion implantation and nuclear backscatter analysis capability.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

8.0007, NUCLEAR RESONANCE AND RELAXATION IN METALS & SUPERCONDUCTORS

D.E. MACLAUGHLIN, Univ. of California, Graduate School, *Riverside, California* 92502 (DMR73-02395 A01)

The research program supported by NSF Grant DMR-7302395 will be continued. Four projects will be undertaken which make use of nuclear magnetic resonance and relaxation as a probe of local magnetic fields in metals and superconductors: (1) A study of Al27 spin-lattice relaxation in dilute superconducting Al3d alloys (3d equals V, Cr, Fe). This work will be undertaken to clarify the nature of previously-observed anomalous relaxation in AlMn. Impurity magnetism is more strongly suppressed in the proposed systems than in AlMn, and the solute dependence of the anomaly will help to elucidate its origin. (2) Measurement of Al27 relaxation rates in small aluminum particles at zero and low applied fields. This project will examine the roles of critical fluctuations and pair breaking in determining quasiparticle excitation spectra in superconductors of reduced dimensionality. (3) An investigation of Zeeman and dipolar relaxation in the mixed state of type-II superconductors. The nature of the relaxation mechanisms involved will be studied, as well as the role of Genack-Redfield thermodynamic quenching of nuclear spin diffusion in the inhomogeneous field of the vortex lattice. (4) Use of the La139 resonance and field- cycling techniques to measure local field distributions and relaxation rates in the (La, Gd)Al2 'spin glass' system, where the onset of frozen- in orientational disorder in the impurity spin system as low temperatures is not well-understood. Studies at low applied fields should eliminate the insensitivity of NMR to the freezing process observed in high-field measurements.

SUPPORTED BY U.S. Natl. Science Foundation

8.0008, RADIATIVE PROCESSES ASSOCIATED WITH COLLISIONS OF HOT ELECTRONS ON PARTIALLY STRIPPED IMPURITY IONS

Y. HAHN, Univ. of Connecticut, Graduate School, *Storrs, Connecticut* 06268 (E(11-1)-2276)

Cross sections for the dielectronic recombination of hot electrons with stripped impurity ions will be calculated. Detailed studies will be made both nonrelativistically for Fe and Mo ions and relativistically for Au and W ions. A sum role procedure will be used to treat the sum over the intermediate excited states which are collisionally produced. Attempts will be made to construct a simple model to be used for more general cases involving different ionic species. Related higher-order processes, such as the excitation-Bremsstrahlung, Auger-ionization, and radiative-Auger emission, will be studied using the same theoretical procedure adopted for the dielectronic recombination calculation.

RESULTS: A simple model for the estimation of the direct radiative capture cross section has been successfully constructed, and has been extensively tested using a nonrelativistic potential calculation and also using a relativistic Hartree-Fock program. The model can provide very simply the capture cross sections to a 20% accuracy for all ionic species and electron temperatures. During the course of testing the model, two sets of computer programs have been developed, one for the nonrelativistic single-particle and the other for the relativistic HF, both of which are needed for the above proposed study. Two papers have been submitted for publication.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - M.F.E.D.

8.0009, APPLICATIONS OF SEMICONDUCTOR MATERIALS

W.J. MOORE, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN620099)

To obtain basic knowledge of the electrical and optical properties of semiconductor materials which limit the performance of solid-state devices of interest to the Navy. Of particular interest are materials which have application as infrared detectors or devices including elemental and compound narrow-gap semiconductors.

Electrical and optical properties of selected materials are determined by using measurements such as: optical and magnetooptical spectroscopy, photoconductivity, photomagnetoelectric effect, Hall effect, and noise studies. Such measurements are carried out on commercially constructed devices such as infrared detectors on specially prepared bulk material produced in-house, and on MOS structures.

ADDENDA: Supporting agency address is: Naval Research Laboratory (5000), Washington, D.C. 20375

SUPPORTED BY U.S. Dept. of Defense - Navy

8.0010, TRACE ELEMENT DETECTION BY ION-INDUCED X-RAYS

H.A. VANRINSVELT, State University of Fla. Sys., School of Arts & Sciences, *Gainesville, Florida* 32601 (R01 GM 20282-03)

This research is to be the continuation of a study concerned with the application of proton-induced x-ray emission (PIXE) analysis to biomedical materials. Techniques developed during the past year will be employed to calibrate the system for quantitative analysis of all trace elements, heavier than sodium, which are found in human organs. This technique will be compared to x-ray fluorescence using radioactive sources and possibly an x-ray tube. Emphasis will be placed on trace elements in human organs. Perfusion techniques will be developed and assessed to eliminate artifactual trace element contribution of blood to specific organs. Cell fractionation studies will be employed to determine partitioning of trace elements in cell fractions. Correlations between race element concentrations and biological parameters such as age, sex, disease state, geographic location, and occupation will be investigated. Prime emphasis will be upon cancer, kidney disease, liver disease, and a variety of metabolic diseases. Whole blood and blood serum will be analyzed to study trace level variation in renal failure patients undergoing regular hemodialysis and patients who have had an ileal by-pass for morbid obesity. Research done the first year shows PIXE analysis to have more than adequate sensitivity for these research projects.

SUPPORTED BY U.S. Dept. of Hlth. Ed. & Wel. - N.I.H.

8.0011, ELEMENTAL X-RAY MICROANALYSIS BY CHARGED-PARTICLE EXCITATION WITH APPLICATION TO LOCAL PROBLEMS

A. KATSANOS, Greek Atomic Energy Comm., *Athens, Greece* (1608/R1/RB)

Elemental X-ray microanalysis is performed by proton irradiation of samples utilizing a 11 MeV Van de Graaff accelerator.

A new technique for proton irradiation of targets in free-air has been developed. An 8 micron beryllium foil used as a proton exit window causes negligible energy loss for as low as 2 MeV protons. The beryllium window can withstand relatively high currents for extended periods of time. This technique facilitates rapid and convenient analysis of all samples (for Z 19) with excellent results. The external beam technique for elemental microanalysis is used with success in several applications such as in analysis of air pollution samples from heavily polluted areas, analysis of

cancer tissue samples, routine analysis for Pb in blood samples of people working in lead contaminated environment, etc. A small scattering changer for in vacuum irradiation is also used for PIXE analysis. Proton-induced X-rays from thin and thick samples are detected using Si(Li) and intrinsic Ge detectors and a 4096 channel analyzer. A CDC-3300 computer was used for analyzing and plotting the data.

This work is part of the IAEA collaboration program of elemental analysis by means of charged particle induced X-rays.

ADDENDA: Performing organization: NRC Demokritos, Aghia Parascevi, Attikis.

SUPPORTED BY Internat. Atomic Energy Agency - Austria

8.0012, EXPERIMENTAL STUDIES IN CRITICAL, BICRITICAL, AND TRICRITICAL PHENOMENA

P.M. HORN, Univ. of Chicago, Graduate School, *Chicago, Illinois* 60637 (DMR75-14360 A01)

A new research program involving a variety of experiments at structural, magnetic, and liquid crystal phase transitions will be started. In particular, an intensive study of critical points associated with the intersection of lines of first and second order phase transitions will be undertaken. The experiments are designed to examine both the critical exponents at these intersections, and the crossover effects these intersections have on critical exponents at nearby points on the lines. The main thrust of the proposed research will be to probe not only the generality and universality of these transitions, but also, in the individual systems, the interactions that drive them.

SUPPORTED BY U.S. Natl. Science Foundation

8.0013, PROPERTIES OF SOLIDS AND MANY PARTICLE SYSTEMS

G.A. BAYM, Univ. of Illinois, School of Liberal Arts & Sci., *Urbana, Illinois* 61801 (DMR75-22241 A01)

This research program previously supported under GP-40395, is mainly concerned with the development of many-body theories and their applications in the areas of critical and tricritical phenomena, lattice statistics, magnetism, low-temperature systems (particularly liquid helium), and astrophysical systems, predominantly the properties of matter at high densities, with application to neutron stars. Work on phase transitions and critical phenomena centers on the application of renormalization-group methods to problems of multicritical behavior, dilute and random systems, and critical dynamics. The focus is particularly on position-space methods for lattice systems in the context of which there seems some hope of attaching global and non- universal aspects of critical behavior and of making detailed contact with the properties of real systems with magnetic or order-disorder transitions. Problems for study in liquid helium include: the interactions among quasiparticles and boson excitations in dilute solutions of He3 in superfluid He4; transport theory and collective behavior of superfluid He3; Landau theory of normal He3; and hydrodynamics of rotating superfluid He4. In the theory of high-density matter, concerns include: pion condensation, and its effects in dense matter on the equation of state, collective modes, and finite temperature behavior; (closely related are studies of the Lorentz-Lorenz effect in pion propagation in nuclear matter). Also, phase transitions in field theories, such as the o model, at finite temperature; studies of equations of state for dense matter at finite temperature, with applications to supernovas, and heavy ion collision, dynamical behavior of neutron stars; storage of elastic energy, starquakes, and wobble, will be considered.

SUPPORTED BY U.S. Natl. Science Foundation

8.0014, NUCLEAR STRUCTURE STUDIES

P.J. DALY, Purdue University, School of Science, *Lafayette, Indiana* 47907 (EY-76-S-02-1672)

An expanded program of experimental investigations of the high-spin level structure of shape transitional nuclei in the region below 208Pb is proposed. The principal aims are to explore the role of rotation alignment coupling and to elucidate the nature of the nuclear shape transition in the region A equals 180-200. Current studies of the nuclei 195Pb, 197Pb, 199Pb, 201Pb, 203Pb and 200Hg, will be completed and the results will be prepared for publication. New investigations of high spin levels in 197Hg and 199Hg by (alpha, 3n gamma) spectroscopy and of neutron deficient Pt nuclei (A less than 189) by (alpha, xn gamma) and (H.I., xn gamma) spectroscopy are planned. In an effort to resolve a current controversy about the nature of the yrast 10 ion and 12 ion states in even-A Pt nuclei, transition probabilities in the backbending region of 188Pt will be determined using the Doppler shift recoil distance technique. A search, concentrated in the region around A 190, will be made for high-K multiquasiparticle yrast traps, using heavy ion beams from the Michigan State University cyclotron.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

8.0015, OHMIC AND HOT ELECTRON MAGNETOPHONON RESONANCE IN SEMICONDUCTORS

J.R. BURKE, U.S. Navy, Res. & Technology Department, *Silver Spring, Maryland* 20910 (DN585316)

To determine the phonans which limit carrier transport in semiconductors in both weak and strong electric fields by magnetophonon resonance experiments.

Measure the magnetoresistance in weak (ohmic) and strong electric fields in magnetic fields up to 100kg at temperatures between 4.2k and 300k. Resonance between the energies of nondispersive phonans and landan state separation are observed as ocillations in the magnetoresistance. The energies of the phonans involved are obtained from the field position of the extreme. Magnetophonan resonance is being examined in IV-VI compounds and alloys as a model system in which the effects of band structure, phonan spectrum, and carrier density on the carrier- phonan interaction can be varied and controlled.

ADDENDA: Supporting agency address is: Office of Naval Research, Code 420, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

8.0016, HIGH-ENERGY PHYSICS

J. BUTTONSHAFER, Univ. of Massachusetts, School of Arts & Sciences, *Amherst, Massachusetts* 01002 (EY-76-S-02-3330)

The E.R.D.A.-supported High-Energy Physics Group at the University of Massachusetts is actively pursuing counter/spark-chamber experiments, primarily at Brookhaven National Laboratory. Target-region apparatus has been developed for the BNL Multi-Particle Spectrometer; and analysis is continuing of extensive data obtained on K* resonances. Additional wire spark chambers and proportional chambers will be employed with the MPS to study negative pion p production of charmed particles. The polarized target will be tested at the BNL in the near future; proposal for using the target for MPS study of strange particles was very well- received.

RESULTS: U. Mass. polarized target reached 65% polarization of protons at 10 kG, 1.3 degrees K. Publications: (1) 'Reaction negative Kaon p yields neutral pion from 1647 to 1715 MeV,' R.A. Ponte et al., Phys. Rev., 12D, 2597-2609 (1975). (2) Development of a Large, Low- Mass, Water Cherenkov Counter,' J. Button-Shafter et al., to be published in Nucl. Instruments and Methods 136. (3) 'A Study of the Reaction negative Kaon p yields lambda positive pion negative pion at Center-of-Mass Energies in the Range 1.65 to 1.72 GeV,' D.A. Evans et al., accepted by Nuclear Physics B. (4) 'Search for the Formation of New Particles in pp Reactions near 3 GeV,' J.R. Bensinger et al., submitted to Nucl. Physics. B.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

8.0017, STATISTICAL MECHANICS AND THE MANY-BODY PROBLEM

F.Y. WU, Northeastern University, Graduate School, *Boston, Massachusetts* 02115 (DMR76-20643)

The phenomena of order-disorder transitions will be investigated through the consideration of model systems in lattice statistics. Specific problems which will be studied include the renormalization group approach to the Ising model, Ising models with two- and four-spin interaction, vertex models and some graph-theoretical problems. The ground state of the one-dimen-

sional Hubbard model will also be studied. In the many-body theory part of the research, the correlated-basis- function formulation of the ground-state properties of an electron gas will be extended to non-zero temperatures. Also, a new method for evaluating the matrix elements for a Fermi system will also be investigated.

This is a renewal of research previously supported under DMR72- 03213 A01.

SUPPORTED BY U.S. Natl. Science Foundation

8.0018, LIGHT SCATTERING IN MAGNETIC SEMICONDUCTORS
M.S. DRESSELHAUS, Mass. Inst. of Technology, School of Engineering, *Cambridge*, *Massachusetts* 02139 (DMR73-02473 A01)

The research will continue and complete a detailed study of the Raman scattering in the europium chalcogenides, with particular reference to the characteristic Raman spectra which are observed in the various magnetic phases of these materials. Attention will be given to the connection between the materials characterization and the Raman spectra. A detailed study will be made of the laser-excitation energy dependence of the resonant Raman scattering associated with ferromagnetically ordered EuS, EuSe and EuTe to show that the maximum resonant enhancement of the scattering intensity occurs in the vicinity of the E1 peak of their respective magnetoreflectance spectra. In addition, resonant Raman scattering in ferromagnetic EuO will be investigated. High magnetic field studies in ferromagnetically ordered EuTe to 135 kOe will be extended, where it is anticipated that magnetic saturation phenomena will be found. Having observed Raman spectra in antiferromagnetic (AF-II) EuTe, it is planned to look for Raman spectra in the low-temperature AF-II phase of EuSe, which is found below approximately 1.8K. A detailed study of the magnetoreflectance and far- infrared spectra associated with the various magnetic phases is planned in conjunction with these Raman studies. Magnon and polariton scattering phenomena in the various magnetic phases of the europium chalcogenides will be studied, and theoretical models will be developed to account for the characteristics of the Raman spectra observed in each of the magnetic phases of these materials.

This is a renewal of Grant No. DMR-7302473 (GH-40854).

SUPPORTED BY U.S. Natl. Science Foundation

8.0019, MOLECULAR MOTION AND ENERGY TRANSPORT IN MOLECULAR AGGREGATES
P.N. PRASAD, State University of New York, Graduate School, *Buffalo*, *New York* 14222 (DMR75-02628)

This research will focus on the process of energy transport through organic molecular aggregates which proceeds by the molecular motions and electronic excitation in various ordered and disordered crystalline aggregates. The investigation of the nature of electron-phonon interaction, and the application of these studies in establishing the detailed nature of the energy transport will be examined. The investigations have both biological and technological applications. In a number of photophysical or photochemical processes in biopolymers, the primary step is the transport of the excitation. On the other hand a study on electron-phonon coupling and molecular motional instability is important for the technology of efficient energy transport and superconductors. The research is divided into four categories on the basis of the technique (Raman, electronic, excited-state microwave resonance, and thermal modulation).

SUPPORTED BY U.S. Natl. Science Foundation

8.0020, THEORETICAL ELEMENTARY PARTICLE PHYSICS
D.R. YENNIE, Cornell University, School of Arts & Sciences, *Ithaca*, *New York* 14853 (PHY76-18018)

Research will be carried out in several areas of elementary particle theory. The broad areas of investigation are: (A) Systems with infinitely many degrees of freedom, with primary emphasis on gauge theories of strong interactions. Two approaches are being employed: the lattice formulation of the theory, and conventional continuum Yang-Mills theory. (B) Symmetries and Dynamics of Hadrons, with interest centering on the spectroscopy of the new particles and the charmonium model. (C) High-Energy Interactions of Hadrons, with emphasis on multiple production and the space-time structure of collisions. (D) Electromagnetic Interaction of Hadrons, largely related to the Cornell experimental program in this field. Interest centers on the patron model and the hadronic structure of the photon. (E) Quantum Electrodynamics. Work will be limited to radiative corrections and other practical calculations. (F) Collaboration with Cornell's Fermilab experimental program.

This work represents a continuation of that currently supported by Foundation grant PHY74-19018 AO3.

SUPPORTED BY U.S. Natl. Science Foundation

8.0021, NUCLEAR STRUCTURE THEORY
J.B. FRENCH, Univ. of Rochester, School of Arts & Sciences, *Rochester*, *New York* 14627 (EY-76-S-02-2171)

Our research program is, broadly, the development and application of nuclear theory, including nuclear structure and nuclear reactions. This involves the development of new general theoretical methods, as well as the detailed examination of particular nuclei or nuclear reactions. We are working in the following areas: 1) Shell-model spectroscopy. Theory of the effective interaction and other aspects of the shell-model from the many-body point of view. 2) Spectral distribution methods in complex nuclei, including level densities and strength distribution, as well as general studies of nuclear symmetries and statistical behavior. 3) Interactions of high-energy particles with nuclei, including the theory of nuclear reactions of elementary particles, as well as nuclear-structure aspects of particle-removal reactions.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

8.0022, PROPERTIES OF MATTER CHANGING PHASE
G. STELL, State University of New York, School of Arts & Sciences, *Stony Brook*, *New York* 11790 (DMR73-07580 A01)

Research on the theory of phase transitions, previously supported under DMR-7307580, will be continued. This is a statistical-mechanical study of the bulk properties - thermodynamic, dielectric and structural - characteristic of matter in or near a change of phase. It entails the continuing development of certain general formalisms applicable to a wide class of systems as well as the specific study of representative problems. These concern the dielectric constant and index of refraction, metamagnetism, adsorption and absorption, hypercriticality, and phase transitions in soft-core metals, fused salts, and related systems.

SUPPORTED BY U.S. Natl. Science Foundation

8.0023, RINS HIGH-INTENSITY NEUTRON SPECTROSCOPY
R.C. BLOCK, Rensselaer Polytechnic Inst., School of Engineering, *Troy*, *New York* 12181 (EY-76-S-02-2494)

Neutron-induced fission cross section measurement will be carried out upon transuranic actinide nuclei using small (10-100 nanogram) samples. The 232Th(n,f) cross section will be determined from 1 to 100 keV. Neutron-induced alpha measurements will be carried out with 6LiF, and 145Nd and 171Yb.

RESULTS: The fission cross section of 238U has been measured from 3 eV to 100 keV. Preliminary fission measurements upon 232Th (n,f) cross section. Preliminary data on 145Nd(n, alpha) 142Ce were obtained. The 237Np(n,f) fission fragment energy distribution has been measured in the low-energy region where substantial subthreshold fission has been observed.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

8.0024, ULTRASONIC INVESTIGATION OF VERY HIGH-DENSITY GASES
S.E. BABB, Univ. of Oklahoma, Graduate School, *Norman*, *Oklahoma* 73069 (ENG75-21641)

The overall objective of the entire research program is to increase our understanding of the basic energies of intermolecular interactions, including multibody forces. In this specific project,

ultrasonic techniques will be used to study very dense gaseous systems. The experimental portion will determine the density as a function of pressure and temperature by studying the propagation of ultrasonic waves through the medium. The pressure will be restricted to the very high- pressure region, i.e., that above 20 kbars, where other methods become unworkable. The gases to be studied include N2, He, Ne, C3H6, C3H8 and hopefully H2 and D2. This work necessitates development of procedure of handling gases under these conditions, and will also produce some information on melting curves of these materials. The computational work is twofold. One aim is to complete a very careful study of the current pertubative approaches to the equation of state at very high densities. The other is to finish a detailed examination of the Prigogine-Nicolis-Misguich theory of dense gas transport plus various derivative versions of this theory and also the Rice-Allnatt theory. This work uses a data base of computed radial distribution functions developed earlier. These computations can evaluate the basic understanding of the processes involved in dense gas transport phenomena.

SUPPORTED BY U.S. Natl. Science Foundation

8.0025, STRATEGIES OF THEORY TESTING
C. GLYMOUR, Univ. of Oklahoma, Graduate School, *Norman, Oklahoma* 73069 (SOC76-83868)

Both Hermann Weyl and Rudolf Carnap suggested that particular hypotheses within a theory might be tested by using evidence statements and other hypotheses of the theory to deduce instances of the hypothesis tested. Weyl did not develop the idea; Carnap gave it a rather unsatisfactory technical form which he quickly abandoned. Besides a careful and explicit development, the suggestion, if it is to be taken seriously, requires application to historical cases to determine whether it really provides any elucidation of scientific practice and, further, requires an investigation of its methodological implications. Dr. Glymour has already given a formal development of the strategy suggested by Weyl and Carnap, and discussed its most obvious methodological implications. He applied the strategy to explicate one of Freud's case studies and used it to try to elucidate both the structure of Newton's argument for universal gravitation and also some of the issues of evidence in the confrontation of Ptolemaic and Copernican astronomy. Most of this work was carried out under NSF Grant 0GS-41764. The present grant will allow him to continue these investigations.

SUPPORTED BY U.S. Natl. Science Foundation

8.0026, ELECTRON TRAPS IN POLAR CRYSTALS
A.B. SCOTT, Oregon State University, School of Science, *Corvallis, Oregon* 97331 (DMR76-80573)

The electronic properties of alkali halides containing a slight excess of the alkali metal have been intensively studied for a number of years; however, some important electron traps have not yet been clearly characterized. These traps strongly influence processes having possible technical applications such as luminescence and laser action, photoconductivity, and information storage.

Principal among traps is the negative-ion vacancy, which on trapping an electron, becomes an F center. Recent experiments indicate that F centers produced by photochemical destruction of hydroxyl ions in KCl differ magnetically from those in pure material. This difference is examined by means of combined optical and electron spin resonance spectroscopy.

The negative-ion vacancy concentration can be controlled by introduction of oxide ions. This provides a means of testing theoretical calculations of the effect of vacancy concentration on the ionization of F centers. Measurements of the drift mobility of F centers in an electric field in both pure and oxide-containing crystals are expected to permit one to select between two conflicting theoretical models. This is a renewal of DMR72-03219.

SUPPORTED BY U.S. Natl. Science Foundation

8.0027, NEUTRON PHYSICS
H.W. LEFEVRE, Univ. of Oregon, School of Liberal Arts, *Eugene, Oregon* 97401 (PHY76-02499 A01)

Measurements near threshold for (p,n) reactions on nuclei in the mass range A equals 53 to 76 will continue as will studies of lithium, deuterium and tritium profiling in solids. Neutron-induced reactions including 10B(n,alpha)7Li and small angle neutron elastic scattering will also be carried out.

This work is a continuation of that currently supported by Foundation grant PHY76-02499.

SUPPORTED BY U.S. Natl. Science Foundation

8.0028, ELECTRONIC SCATTERING AND ELECTRON-IMPURITY INTERACTIONS IN DILUTE METAL AND SEMIMETAL ALLOYS
D.H. LOWNDES, Univ. of Oregon, School of Liberal Arts, *Eugene, Oregon* 97401 (DMR74-07652 A03)

Transport studies of electron-solute atom interactions in both metal and semi-metal alloys previously supported by NSF grant DMR 74- 07652 will be continued. Two new sets of experimental techniques will be applied to unfolding the information contained in the waveshape of the de Haas-van Alphen quantum oscillations (dHvA Waveshape Analysis Methods). The two techniques will be applied, respectively, to metal alloys in the limit in which many Landau levels are occupied, and to semimetal alloys in magnetic fields near the quantum limit. Research includes: (1) studies of conduction electron-local moment interactions in Au (rare earth) and Au (transition metal) dilute alloys, with emphasis on contrasting the microscopic formation in intractions of d- shell and f-shell local moments with conduction electrons; (2) studies of the magnetic field dependent scattering of conduction electrons by long-range impurity potentials, near the quantum limit; (3) interpretation and analysis of measurements of electronic lifetime anisotropy (ELA) over the Fermi surface for many Cu- and Au-based dilute alloy systems; and (4) initiation of exploratory experiments to determine the extent and importance of spin-dependent scattering of conduction electrons and of conduction electron-local moment exchange energy shifts in nearly magnetic Pt-group transition metal dilute alloys.

SUPPORTED BY U.S. Natl. Science Foundation

8.0029, DEFECT ASSOCIATION IN TERNARY OXIDES
D.M. SMYTH, Lehigh University, Materials Research Center, *Bethlehem, Pennsylvania* 18015 (DMR74-21095 A01)

This program continues the study of the defect chemistry of perovskite-structure, ternary oxides, using the techniques established during the past two years. BaTiO3 continues to receive major attention, with particular emphasis on: (1) the behavior of donor-doped samples where it appears that the defect complexes related to BaO-deficiency may be participating in the oxygen equilibration reactions, (2) the mechanism whereby highly donor-doped samples accommodate a stoichiometric and crystallographic excess of oxygen which compensates the donor and yields an insulating material, (3) the transition of acceptor-doped samples from high conductivity at elevated temperatures to high resistivity at room temperature, (4) the crystal site occupied by selected impurities as a function of Ba/Ti ratio, and (5) evidence for the existence of defect complexes by means of dielectric and mechanical relaxation measurements. A further major aspect is the introduction of a parallel study on PbTiO3 with independent control of both the O2 and PbO activities through the vapor phase. The feasibility of growing single crystals of PbTiO3 by the Bridgman technique will be explored.

This program continues research done under DMR-74-21095.

SUPPORTED BY U.S. Natl. Science Foundation

8.0030, EXPERIMENTAL INVESTIGATIONS IN PARTICLE PHYSICS AT INTERMEDIATE ENERGIES
W.K. MCFARLANE, Temple University, School of Liberal Arts, *Philadelphia, Pennsylvania* 19122 (E(11-1)-3539)

The objective of this program is to carry out experiments investigating the properties of elementary particles and their interactions, particularly those accessible in the intermediate energy range. Strong, weak and electromagnetic interactions are being studied using 'electronic' techniques.

We are investigating neutron-proton elastic scattering, single pion production in pp scattering (both at LAMPF, at energies up to 800 MeV) and proton-antiproton annihilation in flight to kaon-antikaon and lambda-antilambda pairs (at BNL).

In electromagnetic interactions, we will search for the three-gamma decay of the pi-zero (at LAMPF), as a test of C-invariance.

In weak interactions, we will measure the rate for pion beta decay, also at LAMPF, as a test of the Conserved Vector Current hypothesis.

RESULTS: Recent contributions have included: an upper limit to direct positron production at 256 and 800 MeV, an upper limit to the existence of stable condensed nuclear states and data on the production of protons, deuterons and tritons in the backward direction at 800 MeV, and a technical paper on multiple scattering. We have also continued to develop our technical capabilities, both hardware and software.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

8.0031, NUCLEAR STRUCTURE AND NUCLEAR REACTIONS

B.L. COHEN, Univ. of Pittsburgh, School of Arts & Sciences, *Pittsburgh, Pennsylvania* 15260 (PHY76-24317)

This proposed action will support the operation of the laboratory and the research program in nuclear structure and reaction studies. In addition, some work in nuclear applications and energy-related research will be supported. The nuclear physics program is a healthy mix consisting of some continuing productive programs and some work in new directions. Perhaps the most obvious example of a new area is the proposed research in weak interactions which will test the fundamental conserved vector current (CVC) theory of beta-decay. The studies of heavy ion fusion and total reaction cross sections are also new areas which are of considerable interest in heavy-ion physics. Work will also continue in areas which have proved particularly fruitful in the past. For example, the pioneering work on quadrupole moment measurements of the first excited states of many nuclei will be extended to look at higher moments in samarium isotopes and to examine the quadrupole moments of excited bands. Studies of the nuclear continuum, a region which has generally received little attention until recently, will also be extended, possibly with the use of heavier ions.

SUPPORTED BY U.S. Natl. Science Foundation

8.0032, THE ROLE OF GRAVITATION IN PHYSICS

B.S. DEWITT, Univ. of Texas, School of Natural Sciences, *Austin, Texas* 78712 (PHY74-03563 A03)

Research initiated under NSF grant MPS74-03563 A01 will be continued. Topics in quantum gravitation and relativistic field theory to be investigated include: 1. Computer calculations of spherically and nonspherically collapsing distributions of matter, of the formation of black holes, and of the gravitational radiation emitted. The computer will also be used to obtain maximal slicings of boosted black holes for use in revised initial data for earlier work on colliding black holes. 2. A study of particle production by strong gravitational fields. 3. Further study of quantum field theory in curved spacetime. 4. Analysis of the concept of 'particle' in curved spacetime through explicit construction of models for detectors. 5. Differential geometry on Z2-graded algebras. 6. Further development of the quantum theory of gravity.

SUPPORTED BY U.S. Natl. Science Foundation

8.0033, STUDY OF NEUTRON-PROTON INTERACTIONS

L.C. NORTHCLIFFE, Texas A & M University System, School of Science, *College Station, Texas* 77843 (E(40-1)-4449)

The objectives of this work are: to determine the spectrum of neutrons produced in 500-800 MeV proton bombardment of deuterium and other light elements; to use the most suitable reaction for the development of monoenergetic neutron beams needed to study the neutron- proton interaction in the 500-800 MeV energy region; to measure the differential cross sections for elastic neutron-proton scattering and for pion production in neutron-proton collisions at 500-800 MeV; to measure the neutron-proton total cross section at 500-800 MeV; to measure the neutron-proton polarization and spin-correlation parameters at 500-800 MeV. These masurements will constitute a complete determination of the neutron-proton interaction in that energy region, realizing one of the fundamental goals of intermediate energy physics. The 500-800 MeV neutron beams will also be used to study the spectra of charged particles produced in neutron bombardment of various nuclei. The experiments will be carried out at the Los Alamos Meson Physics Facility using a magnetic spectrometer, multiwire proportional counters, scintillation counters, a polarized hydrogen target, and other appropriate instrumentation.

RESULTS: New results include measurements of: the differential cross section for n-p elastic scattering at 463 MeV over the center of mass angle range 60-180 degrees; neutron production at 0 degrees in proton bombardment of Ti, Cu, W, Pb and U at 800 MeV; negative pion and positive pion momentum spectra produced in 800 MeV n-p collisions at ten laboratory angles; relative differential cross section for n plus p yields d plus pi degrees at 463, 647, and 800 MeV.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

8.0034, NUCLEAR SPECTROSCOPY WITH HEAVY IONS

T.T. SUGIHARA, Texas A & M University System, Cyclotron Institute, *College Station, Texas* 77843 (E(40-1)-4322)

The study of delayed states with lifetimes in the nanosecond to microsecond range will be continued. Detailed studies of such states have evolved from the development of the broad-range trochoidal electron spectrometer and a post-acceleration beam pulser. High-spin states in nuclei will be studied in heavy-ion reactions. Compound-nuclear reactions will emphasize the use of relatively high-energy, neutron-rich beams on neutron-rich targets; in this way residual nuclei will be produced closer to beta stability and thus less susceptible to charged- particle emission. Direct reactions with heavy ions such as alpha transfer will be investigated to determine whether high-spin states can be excited with small momentum transfer in a peripheral reaction. In- beam studies of actinide nuclei will be continued.

RESULTS: Previous work has stressed structure studies of transitional nuclei. The odd-proton nuclei 153Tb and 155Ho have been found to have decoupled bands. The even-mass 88-neutron nuclei are well described by a microscopic boson-expansion calculation. A simple weak- coupling model accounts for the energies of high-spin isomeric states that have been studied by delayed conversion-electron spectroscopy.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

8.0035, EXPERIMENTS ON THE NUCLEAR INTERACTION OF PIONS AND ELECTRONS

K.O. ZIOCK, Univ. of Virginia, School of Arts & Sciences, *Charlottesville, Virginia* 22903 (E(40-1)-4043)

We propose to carry out several experiments at the Los Alamos Meson Physics Facility. The (pi,pi-p) reactions on some light nuclei will be studied with a new detector system capable of particle identification and high energy resolution up to pion energies of 150 MeV. In this experiment we hope to identify the excited states of the residual nucleus. We will also study elastic scattering of pions on H2, H3, He3, and He4. We expect to complete analysis of old data on scattering from H2, and obtain new data for the other isotopes. We propose to measure the mass difference between charged and neutral pions to precision much better than the present value. At the Space Radiation Effects Laboratory we will continue our studies of particle unstable H4 with a new experiment of higher precision than before. At the Bates Electron Linac we shall investigate electron scattering from 3He and 3H as well as from heavy isotopes, in order to obtain new and better information on the nuclear structure.

RESULTS TO DATE: We have analyzed data on positive pion absorption in light nuclei leading to pairs of charged particles in the final state. We have obtained new corroborating evidence for the existence of particle unstable 4H states decaying rapidly to 3H plus n. We have analyzed old data from Stanford on electron scattering to obtain new information about the structure and charge density of He isotopes. A pion beam monitor using pi-micron decay was designed and is in use at LAMPF.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

8.0036, OPERATIONAL SUPPORT OF SYNCHRO-CYCLOTRON RESEARCH IN PHYSICS
R.T. SIEGEL, Coll. of William & Mary, Space Radiation Effects Lab., *Newport News, Virginia* 23606 (NSF-CA111 A06; MPS-7607123-A06)

The Space Radiation Effects Laboratory Synchrocyclotron will continue to provide good duty-factor beams of protons, pions and muons for intermediate energy physics research. The facility will be operated sixteen eight-hour shifts per week for user groups funded separately. A Program Advisory Committee will select the experiments to be conducted from among unsolicited proposals.

Experiments by user groups will include: studies of muonium: studies of pionic and muonic atoms; nuclear structure studies with protons, deuterons, alpha particles and pions; solid-state physics studies with muons.

This work is a continuation of that currently supported by Interagency Agreement Number NSF-CA-111, Amendment 05.

SUPPORTED BY U.S. Natl. Science Foundation

8.0037, POSITIVE AND NEGATIVE ION COLLISION STUDIES
R. GEBALLE, Univ. of Washington, School of Arts & Sciences, *Seattle, Washington* 98105 (PHY76-02055 A02)

Investigations will continue of collisions of positive and negative ions with gaseous targets. A new experiment has been designed to measure, with higher accuracy than any previous attempt, the positions for many autodetaching states of negative ions and autoionizing states of atoms through the use of UV laser-produced photoelectrons. Measurements of electron spectra from excited states of negative ions produced collisionally at high collision velocity will provide information on the energies for the field-free case which can be compared with precision theoretical calculations. At low collision velocities, the energies of the temporary quasimolecular ion can be measured. These measurements will give new information about potential curves not accessible in other experiments. Measurements will continue of radiation of H-collisions in order to characterize the excitation mechanisms for simple atomic systems exhibiting strong correlations.

This work is a continuation of that currently supported by Foundation grant PHY76-02055.

SUPPORTED BY U.S. Natl. Science Foundation

8.0038, TRICRITICAL PHENOMENA AND STATISTICAL MECHANICS
E.K. RIEDEL, Univ. of Washington, School of Arts & Sciences, *Seattle, Washington* 98105 (DMR75-01070)

A research program previously supported by NSF Grant DMR72-03265 will be continued. In attempting to provide new insight into the problem of the critical behavior of three-dimensional systems, a scaling-field approach will be taken. The expected significance of the scaling-field method is threefold. First, the approach provides the first practical method for Wilson renormalization-group studies of critical phenomena in exactly three dimensions. Second, the approach provides a unified framework for the calculation of critical exponents and scaling functions. Third, the approach is well-suited for discussing complicated kinds of critical phenomena such as phase transitions exhibiting crossover phenomena. The proposed method of calculation is based on a recent successful derivation by Golner and Riedel of an explicit scaling-field representation of Wilson's exact renormalization-group equation for the generalized, continuous-spin Ising model. The research will cover the explicit formulation of the scaling-field approach to critical phenomena in three dimensions and a variety of applications, tests against experiments, and further generalizations of the method.

This research program is a continuation of that began under NSF Grant DMR72-03265 at Duke University.

SUPPORTED BY U.S. Natl. Science Foundation

8.0039, NEUTRON SPECTRA MEASUREMENTS
G.L. WOODRUFF, Univ. of Washington, School of Engineering, *Seattle, Washington* 98105 (E(45-1)-2225 031)

The objective of this project is the measurement of energy spectra from (1) an equilibrium delayed neutron distribution produced from fast fission of 240Pu; (2) separated delayed neutron precursors; (3) neutron emission from fusion-related measurements of delayed neutron spectra. Definitive results have been obtained for the near-equilibrium delayed neutron spectrum from fast-neutron-induced fissions of 232Th, 233U, 235U, 238U and 239Pu samples.

The work now beginning consists of equilibrium delayed neutron spectra measurements from fast fission of 240Pu. These studies will be followed by measurements of separated precursors and will be collected at the Triga Reactor at Washington State University. Following completion of the precursor studies the project will concentrate on measurements using liquid scintillators to obtain neutron spectra from fusion-related materials and from isotopic neutron sources such as 252Cf. In addition, liquid scintillator and proton-recoil data will be combined to provide spectral information corresponding to an energy interval between 10 keV and 14 MeV.

RESULTS: Definitive results for the near-equilibrium delayed neutron spectra from fast-neutron-induced fissions of 232Th, 233U, 235U, 238U and 239Pu have been obtained and submitted for publication.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

8.0040, APPLICATION OF COLLISION THEORY TO RELAXATION PHENOMENA AND LASERS
R.W. CONN, Univ. of Wisconsin, School of Engineering, *Madison, Wisconsin* 53706 (EY-76-S-02-2555)

The purpose of this research is to develop and implement new theoretical methods capable of handling realistic collision problems of interest. We will continue our development of variationally based decomposition methods along with effective Hamilton-type techniques. Special attention will be given to vibrational relaxation of HF. This system is of fundamental theoretical interest, especially concerning the question of rotational state participation in vibrational relaxation. The HF system is also of practical concern as an infrared laser. We also plan to model HF lasing under various experimental conditions and a broader analysis will be made to discern the key physical factors controlling various types of collision behavior. In this regard the temperature and quantum number scaling of vibration-vibration exchange rates will be studied.

RESULTS: Potential surfaces useful for molecular collisions of He- Hf and Ar-HF have been completed. A detailed study of the co-linear atom-deatom problem using various forms of the decomposition method of Conn and Rabitz has been completed with promising results and advances in the theory for applications to reactive scattering have been made. In addition, studies have been completed on relaxation calculations of H2- H2. Continued advances have been made in the development of effective Hamiltonian theory and the method has been formulated in a semiclassical manner to complement the fully quantal formulation.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

8.0041, RESEARCH IN NUCLEAR PHYSICS AND ATOMIC COLLISIONS
H.T. RICHARDS, Univ. of Wisconsin, School of Letters & Science, *Madison, Wisconsin* 53706 (EY-76-C-02-0007, TASK A)

OBJECTIVE: Improve understanding of nuclear forces and structure of nuclei, improve ion sources.

SCIENTIFIC BACKGROUND: The accurate measurement of scattering and reaction cross sections (especially with polarized projectiles) provides the data from which inferences on nuclear forces and structure must come.

PROCEDURE: Test Objects and Agents: An electrostatic tandem accelerator (plus polarized ion source) provides the high-velocity projectiles for probing the selected targets.

Part 1 of 2.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

8.0042, BROAD BAND LASERS
W.M. YEN, Univ. of Wisconsin, School of Letters & Science, *Madison, Wisconsin* 53706 (DN675170; N00014-76-C-0402)

New efficient lasers in the visible and UV are expected to result from this research. The Navy has a need for new lasers to measure the ozone content of the atmosphere and to perform imaging, communications, and surveillance in an underwater atmosphere where blue-green light has the highest transmission.

Broad band fluorescing crystals utilizing 4F to 5D transitions of rare earth activators will be studied with the emphasis on getting new lasers at 3000A and at 4700A. The spectra of the rare earths in various crystals will be measured and lasing will be attempted for crystals with desirable spectra.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, SOLAR ACTIVITY BACK TO 7000 B.C.
C.Y. FAN, Univ. of Arizona, School of Liberal Arts, *Tucson, Arizona* 85721 (ATM74-19507 A01)

This grant will continue the work of Dr. Fan, University of Arizona, on the variation of carbon 14 (C14) in already-dated tree rings. Since the production of C14 is a direct consequence of cosmic ray bombardment of the atmosphere, this is a simple way to study the time variation of the flux of extraterrestrial cosmic rays. Of particular interest during this one year award will be the study of tree rings from the period 1043 to 1065 A.D. It was in 1054 A.D. that the Crab Nebula explosion was observed; this event is now interpreted as a supernovae explosion. The purpose of this award is to investigate the possible atmospheric effects (e.g. excess C14 production) which may have occurred due to an intense beam of gamma rays emanating from the Crab at that time.

This work is being done in collaboration with Professor Fairhall of the University of Washington. It is expected to be completed in a twelve-month period.

SUPPORTED BY U.S. Natl. Science Foundation

10.0002, STUDIES OF WHITE DWARF STARS
P.A. STRITTMATTER, Univ. of Arizona, School of Liberal Arts, *Tucson, Arizona* 85721 (AST76-22263)

White dwarf stars will be investigated from both an observational and theoretical point of view. These stars represent one of the possible endpoints of stellar evolution. They are thus not only of intrinsic interest but provide important information on previous evolutionary phases. Furthermore, physical conditions are often so extreme in white dwarf stars that study of these stars permits many tests of processes thought to take place in normal stars, but for which unambiguous evidence is harder to obtain. The observational part of the program includes projects to: 1) investigate cool white dwarf stars in order to determine the space density of these stars and compare it with theoretical predictions based on analysis of white dwarf cooling times; 2) obtain and analyze the spectra of the more interesting cool white dwarfs with special reference to possible helium as well as hydrogen deficiences; 3) study some of Luyten's high proper motion stars; and 4) measure or set better upper limits to the magnetic fields in DB white dwarf stars.

The theoretical portion of the program includes projects to: 1) construct model atmospheres for cool white dwarf stars with particular reference to abundance analyses and possible selection effects in classifying such stars; 2) work on mass transfer problems in binary star systems; 3) examine the effects of slow accretion onto white dwarf stars and possible nuclear runaways; 4) analyze further the process of accretion onto white dwarfs and explanations of the mono- elemental surface abundances; and 5) analyze data obtained on Nova Cygni 1975 with particular reference to the properties of the ex-white dwarf central star.

This is a continuation of work previously supported by NSF grant AST 75-19757.

SUPPORTED BY U.S. Natl. Science Foundation

10.0003, ROTATION OF VERY YOUNG STARS AND THE ANGULAR MOMENTUM PROBLEM
L.V. KUHI, Univ. of California, School of Letters & Science, *Berkeley, California* 94720 (AST74-08151 A02)

The original research proposal had two basic goals in mind: (1) the determination of rotational velocities of pre-main sequence stars in very young clusters via a Fourier transform technique and (2) the interpretation of these velocities in terms of the location of these stars on the HR diagram. This would ultimately yield information on the behavior of the rotational velocity of a star as a function of its evolutionary age, and provide the basis for the first systematic investigations of the angular momentum problem in stars. During the first year of this grant, the objectives of (1) have been largely met. Material has been obtained in order to locate the stars on the HR diagram. Analysis of this data will be carried out in the coming year in order to interpret the values of the observed rotational velocities. Spectral types, effective temperatures, and total luminosities of these stars will be obtained by an analysis of both optical and infrared data. The stars will be located on evolutionary tracks computed by Larson and Hayashi, and the behavior of rotational velocity will be discussed in terms of physical parameters. This is a continuation of work previously supported by NSF grant AST 74-08151AO1.

SUPPORTED BY U.S. Natl. Science Foundation

10.0004, CHEMICAL COMPOSITIONS OF STARS, NEBULAE, AND GALAXIES (A CRITICAL REEXAMINATION)
L.H. ALLER, Univ. of California, School of Letters & Science, *Los Angeles, California* 90024 (AST76-21457)

Solar abundances of elements which are of special interest in meteoritic and geochemical problems will be determined. The abundances of chemical elements in gaseous nebulae, in supergiant stars and in ionized hydrogen clouds surrounding young stars in galaxies other than our own will be ascertained and interpreted within the framework of current ideas on the origin of the chemical elements and the evolution of stars. Improved data and refined theoretical methods will be used to improve our knowledge of the chemical abundance of supergiant stars in stellar systems near our galaxy--the Magellanic Clouds. Some very hot stars show evidence of material having been ejected from the surface. This material can still be seen surrounding the star and is referred to as a planetary nebula. Theoretical models will be constructed for a certain number of these nebulae, and attempts will be made to make these models as realistic as possible. There will be an effort made to examine possible abundance differences in nebulae having different types of central stars. This will be done by means of a detailed examination of the various physical processes which produce the observed effects. Ionized hydrogen regions are also seen around very hot stars (HII regions). Results of studies of planetary nebulae and HII regions in our galaxy and the Magellanic Clouds will be applied to the determination of abundances of similar objects in other galaxies.

SUPPORTED BY U.S. Natl. Science Foundation

10.0005, COMMUNICATION DISTURBANCE PREDICTION - SOLAR FLARES
M.P. BLEIWEISS, U.S. Navy, Propagation Technology Div., *San Diego, California* 92152 (DN687514)

Determination of solar flare precursor and development of forewarning criteria for the purpose of improved naval communication by minimizing the effects of communications blackouts and disturbances caused by solar flares.

High-resolution solar radiation temperature contour maps will be analyzed by examining the temporal and spatial characteristics of active regions at 3.3 m, 8.6 mm, 2 cm, 3.2 cm and 9.1 cm wavelengths. By comparing active-region parameters obtained from the analysis, a description will be developed to be used in solar flare modeling and to determine solar flare precursor criteria. Correlations to solar emissions at other wavelengths (i.e., optical, x-ray, etc.) will also be considered.

ADDENDA: Supporting agency address is: Naval Electronics Laboratory Center NELC 0200, Office of the Technical Director, San Diego, CA 92152

SUPPORTED BY U.S. Dept. of Defense - Navy

10.0006, ENVIRONMENTAL SUPPORT TECHNOLOGY - THE RADIATION BACKGROUND AT HIGH ALTITUDES & ITS EFFECTS ON COMMUNICATIONS

M.M. SHAPIRO, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN620056)

(1) To make military communications more reliable by acquiring data that will improve the predictability of magnetic storms, polar blackouts, and the interruption of communications during solar flares. (2) To provide timely advice and assistance to NRL scientists and engineers working on those military problems in which knowledge of high- energy physics and its specialized experimental techniques is essential, together with expertise on radiation backgrounds.

Sensitive detection systems are sent aloft in balloons and satellites to study the composition, production mechanisms and sources of the various components of the high-energy particles impinging on earth. Their collisions, multiplication, and energy deposition are investigated to permit evaluation of radiation damage and hazards to high-flying personnel and military systems (e.g., in the SR-71). Accelerator-produced heavy-ion beams are used for calibration.

ADDENDA: Supporting agency address is: Naval Research Laboratory (7000), Washington, D.C. 20375

SUPPORTED BY U.S. Dept. of Defense - Navy

10.0007, THE GRAVITATIONAL COLLAPSE OF STARS AND NUCLEAR ASTROPHYSICS

W.D. ARNETT, Univ. of Illinois, Graduate School, *Urbana, Illinois* 61801 (AST76-20253)

Topics in five broad areas of astrophysics will be investigated: 1) gravitational collapse, 2) stellar evolution, 3) nuclear astrophysics, 4) supernovae, and 5) galactic evolution. The problems of the physics of gravitational collapse, the nature of remnants left by the process, the nature of the progenitors and their evolution to the catastrophe, and the ejection of matter and its nuclear composition will receive most attention. Stellar evolutionary sequences for massive stars will be calculated. The detailed hydrostatic evolution of helium stars in the mass range of 4 to 32 solar masses has been followed from core helium burning through the dynamic formation of a hot neutron star. These evolutionary sequences will be continued and similar calculations for stars of different initial mass will be completed. The cause, nature, and amount of mass ejection from stars will be carefully examined. New and improved quantitative predictions of the nuclear abundances in the ejected matter, and of the size and the nature of condensed remnants will be made. The influence of uncertainties in the physics, in particular in weak interaction theory, will be explored further.

In order to understand the gravitational collapse process, it is necessary to know how a star arrives at the point of instability, which stars do it, and what their configuration is at the time. Such information is a necessary prerequisite for any careful analysis of the collapse itself, and is particularly important since the mechanism for explosion is not known. Such an investigation of the advanced evolution of massive stars is now feasible because of recent advances in the application of nuclear physics and numerical hydrostatics and hydrodynamics to the theory of stars.

SUPPORTED BY U.S. Natl. Science Foundation

10.0008, RESEARCH IN NUCLEAR ASTROPHYSICS

J.W. TRURAN, Univ. of Illinois, School of Liberal Arts & Sci., *Urbana, Illinois* 61801 (AST76-22673)

The research to be done is primarily concerned with two broad topics in nuclear astrophysics: (1) the mechanisms by which heavy nuclei are formed in stellar interiors, novae, and supernovae, and (2) the consequences of mass accretion onto white dwarfs in aging binary systems. Detailed calculations have shown that the composition of matter ejected in nova and supernova explosions is consistent with accurately determined abundances characteristic of solar system material. Specific projects to be undertaken include the following. (1) A variety of calculations pertaining to mechanisms of nucleosynthesis of heavy nuclei will be made. The emphasis in these studies will be on the determination of the temperature, density and time scale conditions under which nucleosynthesis occurs. Such studies serve as well as probes of physical conditions in the appropriate astrophysical environment. (2) Investigations will be carried out of the role of nuclear processes in nova and supernova explosions both in providing the energy requirements and in nucleosynthesis. (3) Calculations will be made of the nuclear reaction and decay properties of nuclei involved in these nucleosynthesis processes aimed at providing improved theoretical estimates for use where experimental results are not available. (4) Studies will be made of the consequences of accretion onto white dwarf stars and neuron stars. (5) Hydrodynamic models will be constructed of light curves for common novae. (6) Explorations of the limiting conditions required for thermonuclear runaways in the hydrogen envelopes of white dwarf stars will be initiated. (7) A reevaluation of nuclear chronologies will be undertaken in the light of recent detection of the short-lived 26Al in meteorites.

SUPPORTED BY U.S. Natl. Science Foundation

10.0009, COMPREHENSIVE CORRELATION OF SOLAR ACTIVITY AND INTERPLANETARY PHENOMENA FOR SOLAR CYCLE 20 (1966 TO 1969)

E.C. ROELOF, Johns Hopkins University, Applied Physics Laboratory, *Laurel, Maryland* 20810 (ATM76-23816)

This grant will support a comprehensive effort to interrelate phenomena on the sun and in interplanetary space during the rise and maximum activity in Solar Cycle 20 (1966-1969). An extensive base of observations has been built up at the Applied Physics Laboratory (The Johns Hopkins University). The APL/JHU group has developed methods for estimating the approximate high coronal source longitude of interplanetary plasma, magnetic field, and energetic particles. This development makes possible the merging of solar and interplanetary data into a common heliographic longitude system for a direct comparison of solar flare and region activity with enhancements of solar wind velocity and low-energy proton and electron fluxes. Deep space observations, available from Mariner and Pioneer spacecraft, will permit the separation of spatial and temporal effects in longitude-dependent interplanetary disturbances. With the acquisition of computer-compatible interplanetary data from the National Space Science Data Center, it is possible to attempt a synthesis and analysis of solar and interplanetary data on a rotation-by-rotation basis that will identify patterns of short term (approximately 1 day) correlated events, of recurrent (approximately 27 days) sequences, and of long-term (approximately 1 year) trends in solar-terrestrial relations. Greatest emphasis will be placed on long-lived solar energetic particle events and recurrent solar wind streams.

The overall aim of this work is to further our understanding of solar activity and its impact on the interplanetary medium and the upper atmosphere.

SUPPORTED BY U.S. Natl. Science Foundation

10.0010, A SEARCH FOR SPHERICAL HALOS OF SPIRAL GALAXIES

D.J. HEGYI, Univ. of Michigan, School of Lit. Sci. & the Arts, *Ann Arbor, Michigan* 48104 (AST76-22109)

An experimental program to detect spherical halos of spiral galaxies using a new photometric instrument, an annular scanning photometer (ASP), will be carried out. In preliminary tests, the ASP has been used to measure the surface brightness of extended objects with an uncertainty of about 0.5%.

The annular scanning photometer has a slit which is rapidly scanned along a circular path tracing out an annulus in the focal plane of a telescope. A combination of rotating lenses and prisms placed behind the slit directs the light to a fixed photomultipler located in a multichannel analyzer which is synchronously advanced in phase with the slit. Because the light path through the instrument is constant, systematic errors are small. Because the scanning period is about 1/50 sec, the ASP is insensitive to airglow fluctuations and instrumental drifts. With this technique, it appears possible to detect signals which are 1/100 of the night sky brightness.

The ASP is a general purpose instrument but it will first be used to investigate the existence of spherical halos surrounding

sprial galaxies. Independent lines of evidence suggest that spiral galaxies possess relatively massive halos which, because they are composed of stars with high mass-to-luminosity ratios, have not yet been detected. Galactic rotation curves, deduced from 21 cm. observations which extend beyond the outer 'edge' of the visible spiral disk, reveal no Keplerian fall-off, indicating that the outer limit of the galactic mass distribution has not been observed. The presently accepted masses of M31 and the Galaxy do not seem great enough to explain the large observed approach velocity. The measurements will give a much better value of the possible mass in the halos.

SUPPORTED BY U.S. Natl. Science Foundation

10.0011, EMPIRICAL DETERMINATION OF VARIABLE STAR DISTANCES AND RADII, A COLLABORATIVE INVESTIGATION BY PURDUE U. & THE U. OF TEXAS AT AUSTIN

T.G. BARNES, Univ. of Texas, School of Natural Sciences, *Austin, Texas* 78712 (AST76-21316)

Among the most sought-after stellar parameters is the distance to various celestial objects. Nearly every astrophysical research endeavor depends at least implicitly upon a reliable stellar distance scale. It is the purpose of this investigation to construct appropriate instrumentation and to examine a new distance determination method advanced by Barnes and his colleagues. The method is based upon an observed tight correlation between a star's visual surface brightness and its V-R (visual minus red magnitude) color index. The relation seems to be valid for all stars of measured angular diameter. From available visual and red brightness measurements, together with velocity in the line of sight measurements, Barnes and his colleagues found that theY could derive both the linear diameter and distance of the classical cepheid variable star, Delta Cephei. The method is important because it is completely independent of all other distance scales. It has advantages of insensitivity to errors in the interstellar extinction and insensitivity to phase misalignments between the photometry and the radial velocities. This research, then, will explore the breadth of applicability of this new stellar distance determination technique.

SUPPORTED BY . U.S. Natl. Science Foundation

10.0012, MULTI-ELEMENT DETECTORS FOR ASTRONOMICAL SPECTROPHOTOMETRY

R.G. TULL, Univ. of Texas, School of Natural Sciences, *Austin, Texas* 78712 (AST75-02404 A03)

An improved astronomical detector system has been developed at McDonald Observatory of the University of Texas. The prototype system has been repackaged to be user-oriented, compact and reliable. A ten- fold gain in information rate has been achieved at the Coude focus of the 107-inch telescope. Two addtional detector systems will be constructed in the next year. They will be matched to instruments at the Cassegrain focus of the 107-inch and the Coude focus of the 82-inch telescope. Several research projects on quasars, stellar envelopes, and the interstellar medium will use these detectors.

A further program of testing will be carried out to better determine the characteristics of this type of detector and to point the way for future improvements.

This is a continuation of work previously supported by NSF grant AST 75-02404.

SUPPORTED BY U.S. Natl. Science Foundation

10.0013, SPECTROSCOPY OF METAL-POOR SYSTEMS AND STARS SHOWING EVIDENCE FOR THE R-PROCESS

G. WALLERSTEIN, Univ. of Washington, School of Arts & Sciences, *Seattle, Washington* 98105 (AST76-22031)

The chemical evolution of the Galaxy will be investigated by means of studies of selected stars whose ages and positions in the Galaxy are particularly relevant to the problem. The emphasis will be on determining abundance ratios that clarify the rate of build-up of elements produced by different nuclear fusion processes taking place in stars. Data on the abundance of interstellar titanium as a function of galactic latitude will be obtained. Observations of the Gum Nebula will be made in order elucidate the kinematics and state of ionization of the interstellar gas. This grant is a renewal of grant AST 75-21218.

SUPPORTED BY U.S. Natl. Science Foundation

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N77-17995*+ National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING. A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 78, JANUARY 1977
Jan. 1977 93 p
(NASA-SP-7037(78)) Avail: NTIS HC E02 CSCL 01A

This bibliography lists 310 reports, articles, and other documents introduced into the NASA scientific and technical information system in December 1976. Author

N77-17996*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PROCEEDINGS OF THE SCAR CONFERENCE, PART 1
1976 478 p refs Conf. Proceedings held at Hampton, Va., 9-12 Nov. 1976 2 Vol.
(NASA-CP-001-Pt-1) Avail: NTIS HC A21/MF A01 CSCL 01C

The Supersonic Cruise Aircraft Research (SCAR) team analyzed six major topics: (1) aerodynamics, (2) stability and control, (3) propulsion, (4) environmental factor, (5) airframe structures and materials, and (6) design integration. For individual titles, see N77-17997 through N77-18018.

N77-17997*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SCAR PROGRAM OVERVIEW **c81**
F. Edward McLean *In its* Proc. of the SCAR Conf., Part 1 1976 p 1-4 (For primary document see N77-17996 09-01)
Avail: NTIS HC A21/MF A01 CSCL 05A

The objectives, program elements, and distribution of research effort in the NASA AST/SCAR Program since its inception in July of 1972 are discussed. The data needed to make rational decisions in the consideration of future military and civil supersonic aircraft were the main directive. Author

N77-17998*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A LINEARIZED THEORY METHOD OF CONSTRAINED OPTIMIZATION FOR SUPERSONIC CRUISE WING DESIGN **c05**
David S. Miller, Harry W. Carlson, and Wilbur D. Middleton (Boeing Commercial Airplane Co., Seattle) *In its* Proc. of the SCAR Conf., Part 1 1976 p 9-24 refs (For primary document see N77-17996 09-01)
Avail: NTIS HC A21/MF A01 CSCL 01C

A linearized theory wing design and optimization procedure which allows physical realism and practical considerations to be imposed as constraints on the optimum (least drag due to lift) solution is discussed and examples of application are presented. In addition to the usual constraints on lift and pitching moment, constraints are imposed on wing surface ordinates and wing upper surface pressure levels and gradients. The design procedure also provides the capability of including directly in the optimization process the effects of other aircraft components such as a fuselage, canards, and nacelles. Author

N77-17999*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ADVANCED SURFACE PANELING METHOD FOR SUBSONIC AND SUPERSONIC FLOW **c02**
Larry L. Erickson, Forrester T. Johnson (Boeing Commercial Airplane Co., Seattle), and F. Edward Ehlers (Boeing Commercial Airplane Co., Seattle) *In its* Proc. of the SCAR Conf., Part 1 1976 p 25-54 refs (For primary document see N77-17996 09-01)
(Contract NAS2-7729)
Avail: NTIS HC A21/MF A01 CSCL 01A

Numerical results illustrating the capabilities of an advanced aerodynamic surface paneling method are presented. The method is applicable to both subsonic and supersonic flow, as represented by linearized potential flow theory. The method is based on linearly varying sources and quadratically varying doublets which are distributed over flat or curved panels. These panels are applied to the true surface geometry of arbitrarily shaped three dimensional aerodynamic configurations. Author

N77-18000*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DEVELOPMENT OF AN AERODYNAMIC THEORY CAPABLE OF PREDICTING SURFACE LOADS ON SLENDER WINGS WITH VORTEX FLOW **c02**
Blair B. Gloss and Forrester T. Johnson (Boeing Commercial Airplane Co., Seattle) *In its* Proc. of the SCAR Conf., Part 1 1976 p 55-68 refs (For primary document see N77-17996 09-01)
Avail: NTIS HC A21/MF A01 CSCL 01A

The Boeing Commercial Airplane Company developed an inviscid three-dimensional lifting surface method that shows promise in being able to accurately predict loads, subsonic and supersonic, on wings with leading-edge separation and reattachment. Author

N77-18001*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE ROLE OF FINITE-DIFFERENCE METHODS IN DESIGN AND ANALYSIS FOR SUPERSONIC CRUISE **c05**
James C. Townsend *In its* Proc. of the SCAR Conf., Part 1 1976 p 69-84 refs (For primary document see N77-17996 09-01)
Avail: NTIS HC A21/MF A01 CSCL 01C

Finite-difference methods for analysis of steady, inviscid supersonic flows are described, and their present state of development is assessed with particular attention to their applicability to vehicles designed for efficient cruise flight. Current work is described which will allow greater geometric latitude, improve treatment of embedded shock waves, and relax the requirement that the axial velocity must be supersonic. Author

N77-18002*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THEORETICAL AND EXPERIMENTAL PRESSURE DISTRI-

BUTIONS FOR A 71.2 DEGREE SWEPT ARROW-WING CONFIGURATION AT SUBSONIC, TRANSONIC, AND SUPERSONIC SPEEDS **c02**

Percy J. Bobbitt and Marjorie E. Manroe (Boeing Commercial Airplane Co., Seattle) *In its* Proc. of the SCAR Conf., Part 1 1976 p 85-122 refs (For primary document see N77-17996 09-01)

Avail: NTIS HC A21/MF A01 CSCL 01A

A wind-tunnel test of an arrow-wing body configuration consisting of flat and twisted wings, as well as a variety of leading- and trailing-edge control-surface deflections, was conducted at Mach numbers from 0.40 to 2.50 to provide an experimental data base for comparison with theoretical methods. Theory-to-experiment comparisons of detailed pressure distributions were made using current state-of-the-art and newly developed attached- and separated-flow methods. Conditions were delineated under which these theories provide accurate basic and incremental aeroelastic loads predictions. Current state-of-the-art linear and nonlinear attached-flow methods were adequate only at small-angle-of-attack cruise conditions. Of the several separated-vortex methods evaluated, only the one utilizing a combination of linear source and quadratically varying doublet panels showed promise of yielding accurate loads distributions at moderate to large angles of attack. Author

N77-18003*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

RESULTS OF RECENT NASA RESEARCH ON LOW-SPEED AERODYNAMIC CHARACTERISTICS OF SUPERSONIC CRUISE AIRCRAFT **c02**

Paul L. Coe, Jr. and A. B. Graham (Old Dominion Univ.) *In its* Proc. of the SCAR Conf., Part 1 1976 p 123-135 refs (For primary document see N77-17996 09-01)

Avail: NTIS HC A21/MF A01 CSCL 01A

The relatively low values of lift-curve slope produced by highly swept arrow wings, coupled with the low scrape angle of the fuselage, resulted in relatively low values of take-off and approach lift coefficients. Through the use of more efficient high-lift systems and the application of propulsive-lift concepts, it is possible to optimize the engine-airframe design for maximum range potential and also to provide good low-speed performance. Nose strakes provide significant improvements in directional stability characteristics and the use of a propulsive lateral control system provides a solution to problems associated with inherently low levels of lateral control. Author

N77-18004*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

UPPER SURFACE NACELLE INFLUENCE ON SCAR AERODYNAMIC CHARACTERISTICS AT TRANSONIC SPEEDS **c02**

Charles E. Mercer and George T. Carson, Jr. *In its* Proc. of the SCAR Conf., Part 1 1976 p 137-154 refs (For primary document see N77-17996 09-01)

Avail: NTIS HC A21/MF A01 CSCL 01A

The arrow-wing transport configuration with detached engines located over the wing to produce upper surface exhaust flow effects was tested at angles of attack from -4 deg to 8 deg and jet total-pressure ratios from 1 (Jet off) to approximately 10. Wing tip leading edge flap deflections of -10 deg to 10 deg were tested with the wing-body configuration only (no nacelles). Tests were made with various nacelle chordwise, spanwise, and vertical height locations over the Mach number, angle of attack, and jet total-pressure ratio ranges. Deflecting the wing tip leading edge flap from 0 deg to -10 deg increased maximum lift to drag ratio by 1.0 at subsonic speeds. Installation of upper surface nacelles (no wing/nacelle pylons) increased the wing-body pitching moment at all Mach numbers and decreased the drag of the wing-body configuration at subsonic Mach numbers. Jet exhaust interference effects were negligible. Author

N77-18005*# McDonnell-Douglas Corp., St. Louis, Mo.

AERODYNAMIC VALIDATION OF A SCAR DESIGN **c02**

Robert L. Roensch *In* NASA. Langley Res. Center Proc. of the Scar Conf., Part 1 1976 p 155-168 refs (For primary document see N77-17996 09-01)

(Contract NAS1-13633)

Avail: NTIS HC A21/MF A01 CSCL 01A

Wind tunnel test of the McDonnell Douglas Supersonic Cruise Aircraft, designed for a cruise Mach number of 2.2, was conducted in the NASA Ames Unitary Plan Wind Tunnels. Extensive force, pressure, and flow visualization data were obtained over a Mach number range from 0.5 to 2.4. Comparisons between theory and measurements of both forces and pressure concentrate on the results obtained in the supersonic tunnel. Schlieren and tuft pictures are presented to help provide an understanding of the nonlinearities observed at off-design conditions. Author

N77-18006*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

DEVELOPMENT OF LONGITUDINAL HANDLING QUALITIES CRITERIA FOR LARGE ADVANCED SUPERSONIC AIRCRAFT **c08**

Robert W. Sudderth (Boeing Commercial Airplane Co., Seattle) and Walter E. McNeill *In its* Proc. of the SCAR Conf., Part 1 1976 p 171-192 refs (For primary document see N77-17996 09-01)

(Contract NAS2-7966)

Avail: NTIS HC A21/MF A01 CSCL 01C

A piloted simulation study was conducted with the aim of advancing the development of longitudinal handling qualities criteria for large supersonic cruise aircraft. The areas of study investigated included high-speed cruise maneuvering, and stall-recovery control power. Comparisons were made with existing criteria and, for the cruise condition, a time response criterion was developed which correlated well with pilot ratings and comments. For low-speed stall recovery a new criterion was developed in terms of nose-down angular acceleration capability. Author

N77-18007*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.

HANDLING QUALITIES ASPECTS OF NASA YF-12 FLIGHT EXPERIENCE **c08**

Donald T. Berry, Donald L. Mallick, and Glenn B. Gilyard *In its* Proc. of the SCAR Conf., Part 1 1976 p 193-214 refs (For primary document see N77-17996 09-01)

Avail: NTIS HC A21/MF A01 CSCL 01C

The handling qualities of the YF-12 airplane as observed during NASA research flights over the past five years were reviewed. Aircraft behavior during takeoff, acceleration, climb, cruise, descent, and landing are discussed. Pilot comments on the various flight phases and tasks are presented. Handling qualities parameters such as period, damping, amplitude ratios, roll-yaw coupling, and flight path response sensitivity are compared to existing and proposed handling qualities criteria. The influence of the propulsion systems, stability augmentation, autopilot systems, atmospheric gusts, and temperature changes are also discussed. YF-12 experience correlates well with flying qualities criteria, except for longitudinal short period damping, where existing and proposed criteria appear to be more stringent than necessary. Author

N77-18008*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SIMULATOR STUDY OF THE LOW-SPEED HANDLING QUALITIES OF A SUPERSONIC CRUISE ARROW-WING TRANSPORT CONFIGURATION DURING APPROACH AND LANDING **c08**

William D. Grantham, Luat T. Nguyen, M. J. Neubauer, Jr., and Paul M. Smith (Vought Corp., Hampton, Va.) *In its* Proc. of the SCAR Conf., Part 1 1976 p 215-248 refs (For primary document see N77-17996 09-01)

Avail: NTIS HC A21/MF A01 CSCL 01C

A fixed-based simulator study was conducted to determine the low-speed flight characteristics of an advanced supersonic cruise transport having an arrow wing, a horizontal tail, and four dry turbojets with variable geometry turbines. The primary piloting task was the approach and landing. The statically unstable (longitudinally) subject configuration has unacceptable low-speed handling qualities with no augmentation. Therefore, a hardened stability augmentation system is required to achieve acceptable handling qualities, should the normal operational stability and control augmentation system fail. In order to achieve satisfactory handling qualities, considerable augmentation was required. Author

N77-18009*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

FLEXSTAB: A COMPUTER PROGRAM FOR THE PREDICTION OF LOADS AND STABILITY AND CONTROL OF FLEXIBLE AIRCRAFT **c08**

Brian R. Perkin (Boeing Aerospace Co., Seattle) and Larry R. Erickson *In its* Proc. of the SCAR Conf., Part 1 1976 p 249-280 refs (For primary document see N77-17996 09-01)

(Contracts NAS2-5006; NAS2-7729; F33615-72-C-1172; F33615-75-C-3132)

Avail: NTIS HC A21/MF A01 CSCL 01C

Capabilities of the FLEXSTAB Computer Program System are described and illustrated. Aeroelastic analysis of a wide variety of aircraft configurations is performed. The aerodynamic theory used in FLEXSTAB is applicable to both steady and unsteady, subsonic and supersonic flow for multiple wing-body tail nacelle configurations with a plane of symmetry. For unsteady flow calculations, an unsteady aerodynamic theory is used which is appropriate for the low reduced frequencies associated with aircraft flight dynamics. The aircraft is modeled as either a rigid or flexible structure. The computer trims the aircraft in steady reference flight and computes both static and dynamic stability and control derivatives and the stability behavior about the trim condition. The airplane lifting pressure distribution, aerodynamic and inertia loads and deflected shape are also computed. Author

N77-18010*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.

PROPULSION SYSTEM/FLIGHT CONTROL INTEGRATION FOR SUPERSONIC AIRCRAFT **c08**

Paul J. Reukauf and Frank W. Burcham, Jr. *In its* Proc. of the SCAR Conf., Part 1 1976 p 281-302 refs (For primary document see N77-17996 09-01)

Avail: NTIS HC A21/MF A01 CSCL 01C

Digital integrated control systems are studied. Such systems allow minimization of undesirable interactions while maximizing performance at all flight conditions. One such program is the YF-12 cooperative control program. The existing analog air data computer, autothrottle, autopilot, and inlet control systems are converted to digital systems by using a general purpose airborne computer and interface unit. Existing control laws are programed and tested in flight. Integrated control laws, derived using accurate mathematical models of the airplane and propulsion system in conjunction with modern control techniques, are tested in flight. Analysis indicates that an integrated autothrottle autopilot gives good flight path control and that observers are used to replace failed sensors. Author

N77-18011*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

FLUTTER SUPPRESSION BY ACTIVE CONTROL AND ITS BENEFITS **c08**

Robert V. Doggett, Jr. and James L. Townsend (Boeing Co., Seattle) *In its* Proc. of the SCAR Conf., Part 1 1976 p 303-333 refs (For primary document see N77-17996 09-01)

Avail: NTIS HC A21/MF A01 CSCL 01C

A general discussion of the airplane applications of active flutter suppression systems is presented with focus on supersonic cruise aircraft configurations. Topics addressed include a brief historical review; benefits, risks, and concerns; methods of application; and applicable configurations. Results are presented where the direct operating costs and performance benefits of an arrow wing supersonic cruise vehicle equipped with an active flutter suppression system are compared with corresponding costs and performance of the same baseline airplane where the flutter deficiency was corrected by passive methods (increases in structural stiffness). The design, synthesis, and conceptual mechanization of the active flutter suppression system are discussed. The results show that a substantial weight savings can be accomplished by using the active system. For the same payload and range, airplane direct operating costs are reduced by using the active system. The results also indicate that the weight savings translates into increased range or payload. Author

N77-18012*# Pratt and Whitney Aircraft Group, West Palm Beach, Fla.

VARIABLE STREAM CONTROL ENGINE CONCEPT FOR ADVANCED SUPERSONIC AIRCRAFT: FEATURES AND BENEFITS **c07**

Robert A. Howlett *In* NASA. Langley Res. Center Proc. of the SCAR Conf., Part 1 1976 p 341-352 refs (For primary document see N77-17996 09-01)

Avail: NTIS HC A21/MF A01 CSCL 21E

The Variable Stream Control Engine is studied for advanced supersonic cruise aircraft. Significant environmental and performance improvements relative to first generation supersonic turbojet engines are cited. Two separate flow streams, each with independent burner and nozzle systems are incorporated within the engine. By unique control of the exhaust temperatures and velocities in two coannular streams, significant reduction in jet noise is obtained. Author

N77-18013*# General Electric Co., Philadelphia, Pa.

ADVANCED SUPERSONIC TECHNOLOGY STUDY: ENGINE PROGRAM SUMMARY. SUPERSONIC PROPULSION: 1971 - 1976 **c07**

J. N. Krebs *In* NASA Proc. of the SCAR Conf., Part 1 1976 p 353-370 (For primary document see N77-17996 09-01)

Avail: NTIS HC A21/MF A01 CSCL 21E

Sustained supersonic cruise propulsion systems for military applications are studied. The J79-5 in the Mach 2 B-58; YJ93 in the Mach 3.0 B-70 and the current F101 in the B-1, are all examples of military propulsion systems and airplanes operated at sustained supersonic cruise speeds. The Mach 2.7 B2707 transport powered by GE4 turbojet engines was the only non-military, sustained supersonic cruise vehicle intended for commercial passenger service. Author

N77-18014*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COMPONENT TEST PROGRAM FOR VARIABLE-CYCLE ENGINES **c07**

Albert G. Powers, John B. Whitlow, and Leonard E. Stitt *In its* Proc. of the SCAR Conf., Part 1 1976 p 371-385 refs (For primary document see N77-17996 09-01)

Avail: NTIS HC A21/MF A01 CSCL 21E

Variable cycle engine (VCE) concepts for a supersonic cruise aircraft were studied. These VCE concepts incorporate unique critical components and flow path arrangements that provide good performance at both supersonic and subsonic cruise and appear to be economically and environmentally viable. Certain technologies were identified as critical to the successful development of these engine concepts and require considerable development and testing. The feasibility and readiness of the most critical VCE technologies, was assessed, a VCE component test program was initiated. The variable stream control engine (VSCE) component test program, tested and evaluated an efficient low emission duct burner and a quiet coannular ejector nozzle at the rear of a rematched F100 engine. Author

N77-18015*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SUPERSONIC CRUISE INLETS FOR VARIABLE-CYCLE ENGINES **c07**

David N. Bowditch *In its* Proc. of the SCAR Conf., Part 1 1976 p 387-397 refs (For primary document see N77-17996 09-01)

Avail: NTIS HC A21/MF A01 CSCL 21E

The performance of candidate supersonic cruise inlets is reviewed and the aerodynamic installation penalties for each type are defined. The main characteristics that affect the airflow schedules of variable cycle engines are defined. These schedules are compared with the airflow schedules of the candidate inlets, and appropriate inlets are matched to the variable-cycle engine characteristics. Auxiliary inlets are also considered. Author

N77-18016*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CONTROL OF PROPULSION SYSTEMS FOR SUPERSONIC CRUISE AIRCRAFT **c07**

Kirby W. Hiller and Daniel I. Drain *In its* Proc. of the SCAR Conf., Part 1 1976 p 399-415 refs (For primary document see N77-17996 09-01)

Avail: NTIS HC A21/MF A01 CSCL 21E

The propulsion control requirements of supersonic aircraft

are presented. Integration of inlet, engine, and airframe controls is discussed. The application of recent control theory developments to propulsion control design is described. Control component designs for achieving reliable, responsive propulsion control are also discussed. Author

N77-18017*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
YF-12 PROPULSION RESEARCH PROGRAM AND RESULTS c07
James A. Albers and Frank V. Olinger *In its* Proc. of the SCAR Conf., Part 1 1976 p 417-456 refs (For primary document see N77-17996 09-01)
Avail: NTIS HC A21/MF A01 CSCL 21E

The objectives and status of the propulsion program, along with the results acquired in the various technology areas, are discussed. The instrumentation requirements for and experience with flight testing the propulsion systems at high supersonic cruise are reported. Propulsion system performance differences between wind tunnel and flight are given. The effects of high frequency flow fluctuations (transients) on the stability of the propulsion system are described, and shock position control is evaluated. Author

N77-18018*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPOSITE MATERIALS RESEARCH IN SUPPORT OF SUPERSONIC PROPULSION SYSTEMS c07
Robert A. Signorelli *In its* Proc. of the SCAR Conf., Part 1 1976 p 457-468 refs (For primary document see N77-17996 09-01)
Avail: NTIS HC A20/MF A01 CSCL 21E

Two engine components, fan blades and exhaust systems, were selected for composite materials development efforts in support of the supersonic cruise aircraft research (SCAR) engine program. The materials selected were boron/aluminum for fan blades and silicon carbide/superalloy sheet for the exhaust system. The current status of the research into applying these two composite materials to SCAR engines is reviewed. Author

N77-18019*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PROCEEDINGS OF THE SCAR CONFERENCE, PART 2
1976 547 p Conf. held at Hampton, Va., 9-12 Nov. 1976 (NASA-CP-001-Pt-2) Avail: NTIS HC A23/MF A01 CSCL 01C

Development advancements of the Supersonic Cruise Aircraft are discussed including environmental engineering aircraft structures and materials and design integration. For individual titles, see N77-18020 through N77-18044.

N77-18020*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AEROACOUSTIC STUDIES OF COANNULAR NOZZLES SUITABLE FOR SUPERSONIC CRUISE AIRCRAFT APPLICATIONS c05
Orlando A. Gutierrez *In its* Proc. of the SCAR Conf., Pt. 2, 1976 20 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01C

Research programs were conducted to investigate experimentally the aeroacoustic characteristics of scale model, inverted-velocity profile coannular nozzles. These programs include studies of unsuppressed configurations with and without center plugs over a variety of radius ratios and area ratios. Also included are suppressed configurations, the effect of ejectors, and some simulated flight effects. Unsuppressed inverted-velocity profile coannular nozzles seem to allow jet mixing noise compliance with present FAR-36 regulations when applied to supersonic cruise aircraft engine cycles. Simulated flight tests suggest that the aeroacoustic benefits of the inverted-velocity profile coannular nozzles would be maintained in flight. Author

N77-18021*# Pratt and Whitney Aircraft Group, West Palm Beach, Fla.
COANNULAR NOZZLE NOISE CHARACTERISTICS AND APPLICATION TO ADVANCED SUPERSONIC TRANSPORT ENGINES c05
Hilary Kozlowski *In* NASA. Langley Res. Center Proc. of the SCAR Conf., Pt. 2, 1976 14 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01C

Recent programs in the field of jet noise, sponsored by the NASA Lewis Research Center, have indicated that the variable stream control engines (VSCE) which are being considered for advanced supersonic cruise aircraft have inherent jet noise advantages over earlier engines. This characteristic is associated with the exit velocity profile produced by such an engine. The high velocity fan stream, on the outer periphery, is acoustically dominant while the primary stream is held to a low velocity and therefore contributes little to the overall noise. Scale model tests have indicated low noise levels. Operation under static conditions, as well as in a relative velocity field (simulating take-off speeds) has indicated large reductions are available from the coannular nozzle and the VSCE. The inherently low levels of jet noise prompted changes in the cycle, which allowed an increase in the amount of augmentation incorporated in the fan stream, without exceeding the suggested noise guidelines, thereby allowing the use of a considerably smaller engine, with obvious vehicle advantages. Author

N77-18022*# General Electric Co., Philadelphia, Pa. Aircraft Engine Group.
COANNULAR PLUG NOZZLE NOISE REDUCTION AND IMPACT OF EXHAUST SYSTEM DESIGNS c07
Robert Lee *In* NASA. Langley Res. Center Proc. of the SCAR Conf., Pt. 2, 1976 20 p (For primary document see N77-18019 09-01)
(Contracts NAS3-18008; NAS3-19777; DOT-OST-30034)
Avail: NTIS HC A23/MF A01 CSCL 20A

Reducing the noise generated by high velocity jets has confronted engine designers and acoustics workers alike for the past fifteen years. Some of the jet noise suppressor configurations that are investigated are shown. With the exception of the early CJ-805 daisy suppressor nozzle which found successful application on the Convair 990 airplane, the others were developmental hardware at different stages of the effort in the past eight years - all aiming at potential supersonic cruise aircraft applications. Some significant progress was made as the result of work supported by NASA and FAA in the past two to three years. This work pertains to the concept demonstration and scale model testing of coannular plug nozzles with inverted velocity profile, and to the preliminary study of its application to advanced variable cycle engines (VCE) appropriate for supersonic cruise aircraft. Author

N77-18023*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CURRENT RESEARCH IN SONIC-BOOM MINIMIZATION c07
Christine M. Darden and Robert J. Mack *In its* Proc. of the SCAR Conf., Pt. 2, 1976 17 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 20A

A review is given of several questions as yet unanswered in the area of sonic-boom research. Efforts, both here at Langley and elsewhere, in the area of minimization, human response, design techniques and in developing higher order propagation methods are discussed. In addition, a wind-tunnel test program being conducted to assess the validity of minimization methods based on a forward spike in the F-function is described. Author

N77-18024*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TECHNOLOGY FOR CONTROLLING EMISSIONS OF OXIDES OF NITROGEN FROM SUPERSONIC CRUISE AIRCRAFT c07
Gregory M. Reck and Richard A. Rudey *In its* Proc. of the SCAR Conf., Pt. 2, 1976 22 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 21E

Various experiments are sponsored and conducted by NASA to explore the potential of advanced combustion techniques for controlling aircraft engine emissions into the upper atmosphere. Of particular concern are the oxide of nitrogen (NOx) emissions into the stratosphere. The experiments utilize a wide variety of approaches varying from advanced combustor concepts to

fundamental flame tube experiments. Results are presented which indicate that substantial reductions in cruise NOx emissions should be achievable in future aircraft engines. A major NASA program is described which focuses the many fundamental experiments into a planned evolution and demonstration of the prevaporized-premixed combustion technique in a full-scale engine. Author

N77-18025*# Federal Aviation Administration, Washington, D.C. Office of Environmental Quality.
CONSIDERATIONS OF HIGH ALTITUDE EMISSIONS c07
Anthony J. Broderick and Nicholas P. Krull *In* NASA. Langley Res. Center Proc. of the SCAR Conf., Pt. 2, 1976 10 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 21E

The status of the Federal Aviation Administration's High Altitude Pollution Program is described which was instituted to develop the detailed quantitative information needed to judge whether or not regulatory action to limit such exhaust emissions would be necessary. The complexities of this question and the nature and magnitude of uncertainties still present in our scientific understanding of the potential interactions between aircraft exhaust emissions and stratospheric ozone and climate are reviewed. The direction and scope of future Federal and international activities are described. Author

N77-18026*# Boeing Commercial Airplane Co., Seattle, Wash.
TITANIUM AND ADVANCED COMPOSITE STRUCTURES FOR A SUPERSONIC CRUISE ARROW WING CONFIGURATION c05
M. J. Turner and J. M. Hoy *In* NASA. Langley Res. Center Proc. of the SCAR Conf., Pt. 2, 1976 24 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01C

Structural design studies were made, based on current technology and on an estimate of technology to be available in the mid 1980's, to assess the relative merits of structural concepts and materials for an advanced arrow wing configuration cruising at Mach 2.7. Preliminary studies were made to insure compliance of the configuration with general design criteria, integrate the propulsion system with the airframe, and define an efficient structural arrangement. Material and concept selection, detailed structural analysis, structural design and airplane mass analysis were completed based on current technology. Based on estimated future technology, structural sizing for strength and a preliminary assessment of the flutter of a strength designed composite structure were completed. An advanced computerized structural design system was used, in conjunction with a relatively complex finite element model, for detailed analysis and sizing of structural members. Author

N77-18027*# Lockheed-California Co., Burbank.
ADVANCED STRUCTURES TECHNOLOGY APPLIED TO A SUPERSONIC CRUISE ARROW-WING CONFIGURATION c05
I. F. Sakata and G. W. Davis *In* NASA. Langley Res. Center Proc. of the SCAR Conf., Pt. 2, 1976 34 p (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01C

The application of advanced technology to a promising aerodynamic configuration was explored to investigate the improved payload range characteristics over the configuration postulated during the National SST Program. The results of an analytical study performed to determine the best structural approach for design of a Mach number 2.7 arrow-wing supersonic cruise aircraft are highlighted. The data conducted under the auspices of the Structures Directorate of the National Aeronautics and Space Administration, Langley Research Center, established firm technical bases from which further trend studies were conducted to quantitatively assess the benefits and feasibility of using advanced structures technology to arrive at a viable advanced supersonic cruise aircraft. Author

N77-18028*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPUTER-AIDED METHODS FOR ANALYSIS AND SYNTHESIS OF SUPERSONIC CRUISE AIRCRAFT STRUCTURES c05
Gary L. Giles *In its* Proc. of the SCAR Conf., Pt. 2, 1976 21 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01C

Computer-aided methods are reviewed which are being developed by Langley Research Center in-house work and by related grants and contracts. Synthesis methods to size structural members to meet strength and stiffness (flutter) requirements are emphasized and described. Because of the strong interaction among the aerodynamic loads, structural stiffness, and member sizes of supersonic cruise aircraft structures, these methods are combined into systems of computer programs to perform design studies. The approaches used in organizing these systems to provide efficiency, flexibility of use in an iterative process, and ease of system modification are discussed. Author

N77-18029*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STRUCTURAL DESIGN STUDIES OF A SUPERSONIC CRUISE ARROW WING CONFIGURATION c05
Jaroslaw Sobieszczanski, L. Arnold McCullers (Vought Corp., Hampton, Va.), Rodny H. Ricketts (Vought Corp., Hampton, Va.), Nick J. Santoro (Vought Corp., Hampton, Va.), Sharon D. Beskenis (Vought, Corp., Hampton, Va.), and William L. Kurtze (Vought Corp., Hampton, Va.) *In its* Proc. of the SCAR Conf., Pt. 2, 1976 25 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01C

Structural member cross sections were sized with a system of integrated computer programs to satisfy strength and flutter design requirements for several variants of the arrow wing supersonic cruise vehicle. The resulting structural weights provide a measure of the structural efficiency of the planform geometry, structural layout, type of construction, and type of material including composites. The material distribution was determined for a baseline metallic structure and the results indicate that an approximate fatigue constraint has an important effect on the structural weight required for strength but, in all cases, additional material had to be added to satisfy flutter requirements with lighter mass engines with minimum fuel onboard. The use of composite materials on the baseline configuration was explored and indicated increased structural efficiency. In the strength sizing, the all-composite construction provided a lower weight design than the hybrid construction which contained composites only in the wing cover skins. Subsequent flutter analyses indicated a corresponding lower flutter speed. Author

N77-18030*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOADS TECHNOLOGY FOR SUPERSONIC CRUISE AIRCRAFT c39
Robert C. Goetz *In its* Proc. of the SCAR Conf., Pt. 2, 1976 22 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 13M

A flight program to measure atmospheric turbulence at high altitudes (long wavelengths) in a variety of meteorological conditions is described and some results obtained in high altitude wind shear are discussed. Results are also presented from wind tunnel test programs to measure fluctuating pressures associated with over-the-wing configurations. A flexible aircraft take off and landing analysis and an active control landing gear analysis, are developed and their capabilities are described. Efforts to validate these analyses with experimental data are also discussed as well as results obtained from parametric studies. Author

N77-18031*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DEVELOPMENTS IN STEADY AND UNSTEADY AERODYNAMICS FOR USE IN AEROELASTIC ANALYSIS AND DESIGN c02
E. Carson Yates, Jr. and Samuel R. Bland *In its* Proc. of the SCAR Conf., Pt. 2, 1976 31 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01A

A review is given of seven research projects which are aimed at improving the generality, accuracy, and computational efficiency of steady and unsteady aerodynamic theory for use in aeroelastic analysis and design. These projects indicate three major thrusts of current research efforts: (1) more realistic representation of steady and unsteady subsonic and supersonic loads on aircraft configurations of general shape with emphasis on structural-

design applications, (2) unsteady aerodynamics for application in active-controls analyses, and (3) unsteady aerodynamics for the frequently critical transonic speed range. The review of each project includes theoretical background, description of capabilities, results of application, current status, and plans for further development and use. Author

N77-18032*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FATIGUE OF TITANIUM ALLOYS IN A SUPERSONIC-CRUISE AIRPLANE ENVIRONMENT c26
L. A. Imig *In its* Proc. of the SCAR Conf., Pt. 2, 1976 18 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 11F

The test programs conducted by several aerospace companies and NASA, summarized in this paper, studied several titanium materials previously identified as having high potential for application to supersonic cruise airplane structures. These studies demonstrate that the temperature (560 K) by itself produced no significant degradation of the materials. However, the fatigue resistance of titanium-alloy structures, in which thermal and loading effects are combined, has been studied insufficiently. The predominant topic for future study of fatigue problems in Mach 3 structures should be the influences of thermal stress particularly, the effects of thermal stress on failure location. Author

N77-18033*# Rockwell International Corp., Downey, Calif.
NEW ADVANCEMENTS IN TITANIUM TECHNOLOGY AND THEIR COST AND WEIGHT BENEFITS c26
Leonard A. Ascani and John K. Pulley *In* NASA. Langley Res. Center Proc. of the SCAR Conf., Pt. 2, 1976 26 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 11F

A process that combines both the superplastic and diffusion bonding properties of metal into one concurrent operation is being developed. Estimates using this technology have indicated that this combined process will result in cost savings up to 70 percent when compared to conventional construction methods, while also saving weight. Many structural forms are possible including sandwich structures made by expanding face sheets and core against die forms. The classic difficulties normally associated with fabricating sandwich structures, such as parts fit-up, close tolerances, adhesive or braze alloy strength, do not exist with this technique. The total potential of Rockwell's patented new processes is limited only by the ingenuity of the designer and is expected to affect significantly future airplane concepts and criteria. Author

N77-18034*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FABRICATION AND EVALUATION OF ADVANCED TITANIUM AND COMPOSITE STRUCTURAL PANELS c26
Thomas T. Bales, Edward L. Hoffman, Lee Payne (Lockheed, Calif. Co., Burbank, Calif.), and Alan L. Carter (NASA Dryden Flight Research Center) *In its* Proc. of the SCAR Conf., Pt. 2, 1976 15 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 11F

Advanced manufacturing methods for titanium and composite material structures are being developed and evaluated. The focus for the manufacturing effort is the fabrication of full-scale structural panels which replace an existing shear panel on the upper wing surface of the NASA YF-12 aircraft. The program involves design, fabrication, ground testing, and Mach 3 flight service of full-scale structural panels and laboratory testing of representative structural element specimens. Author

N77-18035*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TIME-TEMPERATURE-STRESS CAPABILITIES OF COMPOSITES FOR SUPERSONIC CRUISE AIRCRAFT APPLICATIONS c24
J. F. Haskins (General Dynamics Corp./Convair, San Diego, Calif.), J. R. Kerr (General Dynamics Corp./Convair, San Diego, Calif.), and B. A. Stein *In its* Proc. on the SCAR Conf., Pt. 2, 1976 30 p refs (For primary document see N77-18019 09-01) (Contract NAS1-12308)
Avail: NTIS HC A23/MF A01 CSCL 11D

A range of baseline properties was determined for representatives of 5 composite materials systems: B/Ep, Gr/Ep, B/PI, Gr/PI, and B/Al. Long-term exposures are underway in static thermal environments and in ones which simultaneously combine programmed thermal histories and mechanical loading histories. Selected results from the environmental exposure studies with emphasis placed on the 10,000-hour thermal aging data are presented. Results of residual strength determinations and changes in physcial and chemical properties during high temperature aging are discussed and illustrated using metallographic, fractographic and thermomechanical analyses. Some initial results of the long-term flight simulation tests are also included. Author

N77-18036*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ADVANCED SUPERSONIC TECHNOLOGY FUEL TANK SEALANTS c27
Robert W. Rosser and John A. Parker *In its* Proc. of the SCAR Conf., Pt. 2, 1976 15 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 11A

Status of the fuel tank simulation and YF-12A flight tests utilizing a fluorosilicone sealant is described. New elastomer sealant development is detailed, and comparisons of high and low temperature characteristics are made to baseline fluorosilicone sealants. Author

N77-18037*# Boeing Commercial Airplane Co., Seattle, Wash.
TOWARD A SECOND GENERATION FUEL EFFICIENT SUPERSONIC CRUISE AIRCRAFT c05
Frank D. Neumann *In* NASA. Langley Res. Center Proc. of the SCAR Conf., Pt. 2, 1976 18 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01C

Design changes that lead to improved aerodynamic and structural efficiency are presented. Practical design constraints and approaches for a blended wing-fuselage are discussed, as well as the integration of the configuration that leads to aerodynamic and structural efficiency. Highlighted are new approaches used to provide for structural efficiency, airline/passenger acceptance, passenger evacuation, and subsystem integration. Results of full-scale passenger cabin mock-up evaluations are presented showing the feasibility of the concept. Author

N77-18038*# Boeing Commercial Airplane Co., Seattle, Wash.
TOWARD A SECOND GENERATION FUEL EFFICIENT SUPERSONIC CRUISE AIRCRAFT STRUCTURAL DESIGN FOR EFFICIENCY c05
James R. Hoy *In* NASA. Langley Res. Center Proc. of the SCAR Conf., Pt. 2, 1976 13 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01C

The unique challenge of this concept to the structural designer is discussed. The potential of the application of advanced structural design concepts and new titanium fabrication processes is emphasized. Highlighted are the results of a detailed structural analysis, including weight and flutter, showing successful use of the ATLAS structural design and analysis system. It is concluded that blending of the structure may not have an adverse impact on structural efficiency, weight, and manufacturing complexity. Author

N77-18039*# Boeing Commercial Airplane Co., Seattle, Wash.
TOWARD A SECOND GENERATION FUEL EFFICIENT SUPERSONIC CRUISE AIRCRAFT PERFORMANCE CHARACTERISTICS AND BENEFITS c05
John D. Vachal *In* NASA. Langley Res. Center Proc. of the SCAR Conf., Pt. 2, 1976 14 p ref (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01C

The need for greatly improved fuel efficiency and off-design subsonic characteristics is discussed. Engine-airframe matching studies are presented which show the benefits of a configuration designed for much lower supersonic drag levels (blended wing-fuselage) and how well this airframe matches with the new advanced variable-cycle engines. The benefits of advanced takeoff procedures and systems together with the co-annular

noise effect in achieving low noise levels with a small cruise-sized engine are discussed. It is concluded that the technology advances when carefully integrated through detailed engine-airframe matching studies on a validated baseline airplane lead to a much improved supersonic cruise aircraft, i.e., more range, less fuel consumption, noise flexibility and satisfactory off-design characteristics. Author

N77-18040*# McDonnell-Douglas Corp., St. Louis, Mo.
DESIGN FEASIBILITY OF AN ADVANCED TECHNOLOGY SUPERSONIC CRUISE AIRCRAFT **c05**
William T. Rowe *In* NASA. Langley Res. Center Proc. of the SCAR Conf., Pt. 2, 1976 15 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01C

Research and development programs provide confidence that technology is in-hand to design an economically attractive, environmentally sound supersonic cruise aircraft for commercial operations. The principal results of studies and tests are described including those which define the selection of significant design features. These typically include the results of: (1) wind-tunnel tests, both subsonic and supersonic, (2) propulsion performance and acoustic tests on noise suppressors, including forward-flight effects, (3) studies of engine/airframe integration, which lead to the selection of engine cycles/sizes to meet future market, economic, and social requirements; and (4) structural testing. Author

N77-18041*# McDonnell-Douglas Corp., St. Louis, Mo.
STRUCTURAL DESIGN OF SUPERSONIC CRUISE AIRCRAFT **c05**
J. E. Fischler *In* NASA. Langley Res. Center Proc. of the SCAR Conf., Pt. 2, 1976 15 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01C

The major efforts leading to an efficient structural design include: (1) the analysis methods used to improve the structural model optimization and compare the structural concepts, (2) the analysis and description of the fail-safe, crack growth, and residual strength studies and tests, (3) baseline structural trade studies geometry changes, strength, fail-safety, aeroelastics and flutter, (4) comparison of British, French, and United States aluminum alloys with 6AL-4V annealed titanium in structural efficiency after 70,000 hours at temperature, (5) the study of three structural models for aircraft at 2.0 Mach, 2.2 Mach, and 2.4 Mach cruise speeds, (6) the study of many structural concepts to determine their weight efficiencies; and (7) the determination of the requirements for large-scale structural development testing. Author

N77-18042*# McDonnell-Douglas Corp., St. Louis, Mo.
PERFORMANCE AND BENEFITS OF AN ADVANCED TECHNOLOGY SUPERSONIC CRUISE AIRCRAFT **c05**
Richard D. Fitzsimmons *In* NASA. Langley Res. Center Proc. of the SCAR Conf., Pt. 2, 1976 12 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01C

The results of four years research on technology are synthesized in an advanced supersonic cruise aircraft design. Comparisons are presented with the former United States SST and the British-French Concorde, including aerodynamic efficiency, propulsion efficiency, weight efficiency, and community noise. Selected trade study results are presented on the subjects of design cruise Mach number, engine cycle selection, and noise suppression. The critical issue of program timing is addressed and some observations made regarding the impact that timing has on engine selection and minimization of program risk. Author

N77-18043*# Lockheed-California Co., Burbank.
AN ADVANCED CONCEPT THAT PROMISES ECOLOGICAL AND ECONOMIC VIABILITY **c05**
Bruce R. Wright, Thomas A. Sedgwick, and David M. Urie *In* NASA. Langley Res. Center Proc. of the SCAR Conf., Pt. 2, 1976 46 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01C

The actuality of supersonic commercial service being provided by Concorde is demonstrating to the world the advantages offered by supersonic travel for both business and recreation. Public acceptance will gradually and persistently stimulate interest to proceed with a second generation design that meets updated economic and ecological standards. It is estimated that this concept could operate profitably on world-wide routes with a revenue structure based upon economy fares. Airplanes will meet all present day ecological requirements regarding noise and emissions. Author

N77-18044*# McDonnell-Douglas Corp., St. Louis, Mo.
MARKET TRENDS **c83**
Richard D. Fitzsimmons *In* NASA. Langley Res. Center Proc. of the SCAR Conf., Pt. 2, 1976 16 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 05C

A very large segment of the over water, long haul passenger market, 31% of the passengers who provide 42% of the passenger revenue, offers a significant market for an advanced supersonic transport. This is for both the first class and full-fare economy passenger markets. The supersonic transport may be more competitive here in spite of lower costs of subsonic transports, as passenger preference is a more powerful variable than DOC. This latter fact was amply demonstrated in the late fifties when the jets completely replaced the reciprocating engine transports on most world routes, in spite of slightly higher fares. Author

N77-18045# RAND Corp., Santa Monica, Calif.
SCHEDULED MAINTENANCE POLICIES FOR THE F-4 AIRCRAFT: RESULTS OF THE MAINTENANCE POSTURE IMPROVEMENT PROGRAM
Ralph Elwell and Chris Roach Jun. 1976 75 p refs
(Contract F44620-73-C-0011)
(AD-A030146; R-1942-PR) Avail: NTIS HC A04/MF A01 CSCL 01/3

Maintenance procedures for the F-4 aircraft in support of the AF Maintenance Posture Improvement Program were examined. The F-4 has been receiving maintenance on two independent schedules, one being a major calendar-based overhaul at a depot, the other being less drastic maintenance phased into six evenly spaced inspections and cyclically performed at the air base every 450 flying hours. It was found that: (1) certain minor inspections were unnecessary or unnecessarily frequent; (2) it was possible, with safety, to extend the base to 600 hours; and (3) many individual base inspections could be performed more efficiently during the dismantling at the depot. With all three steps implemented, it is estimated that, for the entire F-4 force, 1,537,500 maintenance man-hours (over 70 percent) per year would be saved. Furthermore, the number of aircraft tied up in the inspection docks on any given day would be reduced nearly 70 percent -- from 129 to 41. GRA

N77-18046# Saint Louis Univ., Cahokia, Ill. Parks Coll.
AH-1G FLAT RATE MANUAL Final Report, 1 Jul. 1970 - 1 Jul. 1974
Harold W. Sutphin, William E. Brand, and Gary Crawford 30 Aug. 1976 415 p refs
(Contract DAAJ01-72-A-0027)
(AD-A029933; USAAVSCOM-TR-76-40) Avail: NTIS HC A18/MF A01 CSCL 15/5

The purpose of this Flat Rate Manual is to provide statistical man-hour parameters for the performance of tasks involved at the Organizational, Direct, and General maintenance levels for the AH-1G aircraft. It is intended for evaluating and predicting maintenance requirements and/or comparing the performance of an activity against a recognized standard. Author (GRA)

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N77-18047*# Scientific Translation Service, Santa Barbara, Calif.
EFFECT OF THE POSITION OF MAXIMUM THICKNESS AND OF THE LENGTH OF BODIES OF REVOLUTION ON

THE AERODYNAMIC COEFFICIENTS IN SUPERSONIC FLOW

H. Riedel, H. Emunds, and F. J. Niezgodka Washington NASA Jul. 1976 45 p refs Transl. into ENGLISH from Deut. Luft- und Raumfahrt (West Ger.), RR-70-54, 1970 p 1-185
(Contract NASw-2791)
(NASA-TT-F-16735; RR-70-54) Avail: NTIS HC A03/MF A01 CSCL 01A

The aerodynamic coefficients of bodies of revolution consisting of a ogive-cylinder combinations were determined in the 30 x 30 sq cm supersonic wind tunnel by force and pressure measurements for the Mach number range 1.57 to 4.15. A comparison was made of the results with the slender body theory. Author

DATA SUMMARY: Diverse data are presented; variables include angle of attack, Mach number, lift coefficient, forebody lift coefficient, pitching moment coefficient, normal force coefficient, static pressure coefficient, ground pressure coefficient, drag coefficient, and forebody drag coefficient.

N77-18048*# Kanner (Leo) Associates, Redwood City, Calif.
TWO AND THREE DIMENSIONAL FLOWS AROUND BLUNT BODIES WITH SPECIAL REGARD TO TRANSONIC FREE STREAM MACH NUMBERS

C. Weiland Washington NASA Feb. 1977 24 p refs Transl. into ENGLISH from Z. fur Flugwissenschaften (West Germany), v. 24, n. 5, 1976 p 237-245
(Contract NASw-2790)
(NASA-TT-F-17406) Avail: NTIS HC A02/MF A01 CSCL 01A

Flow streams are calculated for ideal, inviscid gases flowing around blunt bodies at free stream Mach numbers slightly larger than 1, using gas dynamics conservation theorems for inviscid flows, integrated with the difference method of Lyubimov and Rusanov. Sample calculations are given, and theoretical results are compared with available experimental data. Author

DATA SUMMARY: Six different flows around ellipses and spheres were calculated using various Mach numbers; variables include free flow Mach number, flow gas, angle of attack, flow configuration, body shape, front wave, sound line, density distribution, Mach number, and pressure distribution; 13 figures and 1 table include numeric data.

N77-18049*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL AND THEORETICAL LOW-SPEED AERODYNAMIC CHARACTERISTICS OF A WORTMANN AIRFOIL AS MANUFACTURED ON A FIBERGLASS SAILPLANE

Dan M. Somers Washington Feb. 1977 50 p refs
(NASA-TN-D-8324; L-10869) Avail: NTIS HC A03/MF A01 CSCL 01A

A low turbulence pressure tunnel evaluation is reported for low speed aerodynamic characteristics of the FX 66-17AII-182 airfoil as manufactured on a fiberglass sailplane. The results were compared with data for design coordinates obtained from another low turbulence wind tunnel and with theoretical calculations generated by a viscous flow airfoil computer program. The investigation was performed over a Reynolds number range, based on airfoil chord, of approximately 0.5 x 1 million to 6 million and a Mach number range of about 0.05 to 0.35. Comparison with data from another wind tunnel for the design coordinates showed slightly higher drag for the manufactured section.Author

DATA SUMMARY: Considering laminar airfoil of fixed geometry and fiberglass construction; the variables include design coordinates, angle of attack, pressure distribution, lift drag ratio, Reynolds number, Mach number, laminar flow, pitching moment, and boundary layer transition; 18 figures and 2 tables.

N77-18050*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COLD AIR PERFORMANCE OF A TIP TURBINE DESIGNED TO DRIVE A LIFT FAN. 2: PARTIAL ADMISSION

Jeffrey E. Haas, Milton Koeskex, Glen M. Hotz, and Samuel M. Futral, Jr. Washington Feb. 1977 27 p refs Prepared in cooperation with Army Air Mobility Res. and Develop. Lab., Cleveland
(NASA-TM-X-3481; E-8914) Avail: NTIS HC A03/MF A01 CSCL 01A

Partial admission performance was obtained for a 0.4 linear scale version of the LF460 lift fan turbine over a range of speed from 40 to 140 percent of design equivalent speed and a range of scroll inlet total to diffuser exit static pressure ratio from 2.2 to 5.0. The investigation was conducted in two parts, with each part using a different side of the turbine scroll to simulate loss of a gas generator. Each side had an arc of admission of 180. Results are presented in terms of specific work, torque, mass flow, and efficiency. Author

DATA SUMMARY: Partial admission performance of 0.4 linear scale lift fan turbine over a range of speed and pressure ratio; variables include mass flow rate, pressure ratio, equivalent torque, design equivalent speed, stator inlet and rotor exit flow conditions, flow velocity, flow angle, and equivalent specific work; 12 figures and 2 tables.

N77-18051*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ACOUSTIC AND AERODYNAMIC PERFORMANCE OF A VARIABLE-PITCH 1.83-METER-(6-FT) DIAMETER 1.20-PRESSURE-RATIO FAN STAGE (QF-9)

Frederick W. Glaser, Richard P. Woodward, and James G. Lucas Washington Feb. 1977 67 p refs
(NASA-TN-D-8402; E-8837) Avail: NTIS HC A04/MF A01 CSCL 01A

Far field noise data and related aerodynamic performance are presented for a variable pitch fan stage having characteristics suitable for low noise, STOL engine application. However, no acoustic suppression material was used in the flow passages. The fan was externally driven by an electric motor. Tests were made at several forward thrust rotor blade pitch angles and one for reverse thrust. Fan speed was varied from 60 to 120 percent of takeoff (design) speed, and exhaust nozzles having areas 92 to 105 percent of design were tested. The fan noise level was at a minimum at the design rotor blade pitch angles of 64 deg for takeoff thrust and at 57 deg for approach (50 percent takeoff thrust). Perceived noise along a 152.4-m sideline reached 100.1 PNdb for the takeoff (design) configuration for a stage pressure ratio of 1.17 and thrust of 57,600 N. For reverse thrust the PNL values were 4 to 5 PNdb above the takeoff values at comparable fan speeds. Author

DATA SUMMARY: Sound pressure level, sound power level, and perceived noise level of low noise STOL engine fan stage; the variables include stage total pressure ratio, rotor tip speed, inlet weight flow, rotor blade pitch angle, design nozzle area (sq m), Mach number, stall line, fan speed, thrust load, sound pressure level (db), sound power level (db), perceived noise (PNdb), and stage adiabatic efficiency; 39 figures and 4 tables.

N77-18052*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECTS OF SPOILERS AND GEAR ON B-747 WAKE VORTEX VELOCITIES

A. B. Luebs, J. G. Bradfute, and D. L. Ciffone Aug. 1976 25 p refs
(NASA-TM-X-73197; A-6881) Avail: NTIS HC A02/MF A01 CSCL 01A

Vortex velocities were measured in the wakes of four configurations of a 0.61-m span model of a B-747 aircraft. The wakes were generated by towing the model underwater in a ship model basin. Tangential and axial velocity profiles were obtained with a scanning laser velocimeter as the wakes aged to 35 span lengths behind the model. A 45 deg deflection of two outboard flight spoilers with the model in the landing configuration resulted in a 36 percent reduction in wake maximum tangential velocity, altered velocity profiles, and erratic vortex trajectories. Deployment of the landing gear with the inboard flaps in the landing position and outboard flaps retracted had little effect on the flap vortices to 35 spans, but caused the wing tip vortices to have: (1) more diffuse velocity profiles; (2) a 27 percent reduction in maximum tangential velocity; and (3) a more rapid merger with the flap vortices. Author

DATA SUMMARY: Wake vortex minimization by spoilers and landing gear; the variables include wake velocity profile, vortex trajectory, wing tip vortex formation, flap vortex formation, and lift coefficient; 9 figures and no tables.

N77-18053*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

SIDE FORCES ON A TANGENT OGIVE FOREBODY WITH A FINENESS RATIO OF 2.5 AT HIGH ANGLES OF ATTACK AND LOW SPEED

Earl R. Keener and Jose Valdez Dec. 1976 23 p refs

(NASA-TM-X-73176; A-6797) Avail: NTIS HC A02/MF A01 CSCL 01A

A wind tunnel study to determine the subsonic aerodynamic characteristics, at high angles of attack, of a tangent ogive forebody with a fineness ratio of 2.5, is reported. Static longitudinal and lateral-directional stability data were obtained at Reynolds numbers ranging from 0.4 x 1 million to 3.7 x 1 million (based on base diameter) at a Mach number of 0.25. Angle of attack was varied from 36 deg to 88 deg at zero sideslip. It was found that at low Reynolds numbers the forebody does not have a side force att high angles of attack; however, at Reynolds numbers above about 2 x 1 million, a side force occurs in the angle of attack range from 45 deg to 80 deg. The maximum side force is as large as the maximum normal force. The maximum normal force coefficient varies between 1.0 and 2.0 over the Reynolds number range tested and occurs at angles of attack near 65 deg. Author

DATA SUMMARY: Wind tunnel tests on forebody alone and forebody plus afterbody models; the variables include aerodynamic coefficient, angle of attack, sideslip, and Reynolds number; 5 figures and no tables.

N77-18054*# Illinois Univ., Urbana-Champaign. Dept. of Mechanical and Industrial Engineering.

VISCID-INVISCID INTERACTION ASSOCIATED WITH INCOMPRESSIBLE FLOW PAST WEDGES AT HIGH REYNOLDS NUMBERS

N. R. Warpinski and W. L. Chow Feb. 1977 144 p refs

(Grant NGL-14-005-140)

(NASA-CR-149663; ME-TR-395-4; UILU-ENG-77-4001) Avail: NTIS HC A07/MF A01 CSCL 01A

An analytical method is suggested for the study of the viscid-inviscid interaction associated with incompressible flow past wedges with arbitrary angles. It is shown that the determination of the nearly constant pressure (base pressure) prevailing within the near wake is the core of the problem. The basic free streamline flow field is established through two discrete parameters which should adequately describe the inviscid flow around the body and the wake. The viscous flow processes such as the boundary layer buildup, turbulent jet mixing, and recompression are individually analyzed and attached to the inviscid flow in a boundary layer context. It is found that the reattachment point behaves as a saddle point singularity for the system of equations describing the recompressive viscous flow processes. This behavior is then exploited for the establishment of the overall flow field. Detailed results such as the base pressure, pressure distributions on the wedge and the geometry of the wake are determined as functions of the wedge angle. The influence of the boundary layer thickness prior to separation as well as the spread rate parameter within the turbulent mixing region is demonstrated. Author

DATA SUMMARY: Diverse data are presented; variables include pressure coefficient, flow velocity, angles, momentum thickness, displacement, shear stress, Reynolds stress, drag coefficient.

N77-18055*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

COMPUTER PROGRAM FOR CALCULATING AERODYNAMIC CHARACTERISTICS OF UPPER-SURFACE-BLOWING AND OVER-WING-BLOWING CONFIGURATIONS

C. Edward Lan (Kansas Univ.), Greg L. Fillman (Kansas Univ.), and Charles H. Fox, Jr. Feb. 1977 38 p refs

(NASA-TM-X-73987) Avail: NTIS HC A03/MF A01 CSCL 01A

The program is based on the inviscid wing-jet interaction theory of Lan and Campbell, and the jet entrainment theory of Lan. In the interaction theory, the flow perturbations are computed both inside and outside the jet, separately, and then matched on the jet surface to satisfy the jet boundary conditions. The jet Mach number is allowed to be different from the free stream value (Mach number nonuniformity). These jet boundary conditions require that the static pressure be continuous across the jet surface which must always remain as a stream surface. These conditions, as well as the wing-surface tangency condition, are satisified only in the linearized sense. The detailed formulation of these boundary conditions is based on the quasi-vortex-lattice method of Lan. Author

DATA SUMMARY: No numeric data are presented.

N77-18056*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF CASING TREATMENT OF OVERALL PERFORMANCE OF AXIAL-FLOW TRANSONIC FAN STAGE WITH PRESSURE RATIO OF 1.75 AND TIP SOLIDITY OF 1.5

Walter M. Osborn and Royce D. Moore Washington Feb. 1977 23 p refs

(NASA-TM-X-3477; E-8488) Avail: NTIS HC A02/MF A01 CSCL 01A

The effect of a number of casing treatments on the overall performance of a 1.75-pressure-ratio, 423-m/sec-tip-speed fan stage was evaluated. The skewed slot configuration with short-open slots over the midportion of the rotor had a stall margin of 23.5 percent, while the solid casing had a stall margin of 15.0 percent. The skewed slot configuration with long open slots extending ahead of and over portion of rotor displaced the stall line to the lowest flow at all speeds tested. At design speed, the peak efficiency for the long, forward open slots was 1 point less than that for the short midopen slots and 3 points less than that for the solid casing. Author

DATA SUMMARY: The effectiveness of a solid casing, a teardrop casing, and eight variations of a skewed slot casing based on the increase in stall margin and on the ability to displace the stall in line to lower flows; variables include percent speed, flow, pressure ratio, temperature ratio, adiabatic efficiency, stall margin, peak efficiency, radius, and axial distance; 3 figures and 3 tables include numeric data.

N77-18057# Sandia Labs., Albuquerque, N.Mex.

WIND TUNNEL PERFORMANCE DATA FOR THE DARRIEUS WIND TURBINE WITH NACA 0012 BLADES

Bennie F. Blackwell, Robert E. Sheldahl, and Louis V. Feltz May 1976 61 p

(Contract AT(29-1)-789)

(SAND-76-0130) Avail: NTIS HC A04/MF A01

Five blade configurations of a 2-meter-diameter Darrieus wind turbine have been tested in a low speed wind tunnel. The airfoil section for all configurations was NACA 0012. The parameters measured were torque, rotational speed, and tunnel conditions. Data are presented in the form of power coefficient as a function of tip-speed ratio for the various solidities, Reynolds number, and freestream velocities tested. ERA

DATA SUMMARY: Power coefficients of 2-m diameter wind turbines; the variables include torque, tip speed, Reynolds number, wind velocity, chord (cm), chord (Reynolds number), rotor speed, number of blades, and power efficiency; 19 figures and 1 table.

N77-18058# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).

THEORETICAL METHOD FOR CALCULATION OF BODY AND WING-BODY CONFIGURATION COEFFICIENTS UP TO EXTREMELY HIGH ANGLES OF ATTACK [THEORETISCHES VERFAHREN ZUR BEIWERTBERECHNUNG VON RUEMPFEN UND FLUEGEL-RUMPFANORDNUNGEN BIS ZU EXTREM HOHEN ANSTELLWINKELN]

D. Nikolitsch Bonn DOKZENTBw 1976 50 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung

(BMVg-FBWT-76-10) Avail: NTIS HC A03/MF A01; DOKZENTEw DM 30

An analysis is presented to determine nonlinear force and pitching moment characteristics of slender bodies and wing-body-configurations at high angles of attack in subsonic flow up to M = 1. The method is based on the multi-vortex-model of Wardlaw. Nielsen's aerodynamic coefficient-synthesis is improved by taking into account the influence of detached body vortices on the wing. The nonlinear lifting surface-theory of Gersten is modified for application at higher angles of attack. The overall aerodynamic coefficients determined by the present analysis show good agreement with experimental results. Author (ESA)

DATA SUMMARY: Vortex flow field model for determining aerodynamic coefficients of slender bodies and wing-body configurations in subsonic flow; the variables include angle of attack, Mach number, body-wing configurations, slender bodies, aerodynamic forces, pressure distribution, vortex sheets, flow separation, flow compressibility, pitching moment, and lift drag ratio; 21 figures and no tables.

N77-18059# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).

COMPUTER PROGRAM FOR ESTIMATING COEFFICIENTS OF AXISYMMETRIC BODIES AT EXTREMELY HIGH ANGLE OF ATTACK [EIN RECHENPROGRAMM ZUR ABSCHAETZUNG VON BEIWERTEN ROTATIONSSYMMETRISCHER RUEMPFE BEI EXTREM HOHER ANSTELLUNG]

G. Gregoriou Bonn DOKZENTBw 1976 42 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung

(BMVg-FBWT-76-11) Avail: NTIS HC A03/MF A01; DOKZENTEw DM 30

Based mainly on existing theoretical and experimental results, a computer program was developed for the estimation of aerodynamic coefficients of bodies at arbitrary angles of attack and Mach numbers. The determination of accurate results at small angles of attack, was included. The comparison between several theoretical and experimental results was generally very satisfactory. Author (ESA)

DATA SUMMARY: Computerized estimation of viscous normal force, pitching moment, and sideslip at incidences up to 90 deg; the variables include angle of attack, flow velocity, Mach number, cross flow, sideslip, aerodynamic coefficient, Reynolds number pitching moment, viscous drag, and body dimensions; 20 figures and no tables.

N77-18060# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.

ON THE UNSTEADY AERODYNAMIC CHARACTERISTICS OF OSCILLATING AIRFOILS IN TWO-DIMENSIONAL TRANSONIC FLOW

H. Tijdeman 4 Mar. 1976 49 p refs Presented at the ONR Transonic Flow Conf., Los Angeles, 30-31 Mar. 1976 Sponsored by Neth. Agency for Aerospace Programs

(NLR-MP-76003-U) Avail: NTIS HC A03/MF A01

An illustration is given of the typical high subsonic and transonic effects as occurring in the unsteady flow around oscillating two-dimensional airfoils. For this purpose use is made of experimental results for a 6% thick airfoil (NACA 64A 006) with oscillating trailing edge flap and results for a 16.5% thick so-called shock-free airfoil (NLR 7301), performing oscillations in pitch in both the design and in some off-design conditions. With the help of the experimental data the mechanism of the interaction between the steady and unsteady flow field is demonstrated, and it is shown that the periodical motion of the shock waves may introduce a significant contribution to the overall unsteady airloads. On the basis of the experimental results, the capability of a new generation of calculation methods for unsteady transonic flow was evaluated which consider the effects of both wing thickness and oscillating shock waves.

Author (ESA)

DATA SUMMARY: Aerodynamic forces on oscillating transonic wings of 6 percent- and 16.5 percent-thickness; the variables include unsteady pressure, two dimensional flow, three dimensional flow, phase angle, incidence, aerodynamic lift, pressure distribution, wave propagation, flow distribution, shock wave motion history, subsonic flow, transonic flow, transition points, boundary layer flow, and airfoil thickness; 24 figures and 1 table.

N77-18061# Naval Postgraduate School, Monterey, Calif.

THE FREQUENCY RESPONSE AND OPERATING CHARACTERISTICS OF THE XR-3 LOADS AND MOTIONS PROGRAM M.S. Thesis

Bryant Fred Booth, III Jun. 1976 161 p refs

(AD-A028878) Avail: NTIS HC A08/MF A01

The XR-3 Loads and Motions Program, a digital computer simulation of the six degrees-of-freedom equations of motion for the XR-3 captive air bubble test craft, is subjected to a wide range of regular and irregular wave excitations. The operating characteristics of the simulated craft and the frequency response functions for the heave, pitch, and roll responses in ahead, abeam, and following seas are obtained for regular wave excitations. The ahead seas frequency response functions are verified with irregular wave excitation. GRA

DATA SUMMARY: Diverse data are presented; variables include wave height, wave frequency, time, heave, pitch, speed, pressure, thrust, roll, and wave amplitude.

N77-18062# Naval Ship Research and Development Center, Bethesda, Md.

A STATISTICAL DESCRIPTION OF PRESSURE AND VELOCITY FIELDS AT THE TRAILING EDGES OF A FLAT STRUT

William K. Blake Dec. 1975 171 p refs

(SF43452707; ZR0110801)

(AD-A028771; DTNSRDC-4241) Avail: NTIS HC A08/MF A01 CSCL 13/10

An experimental determination has been made of the turbulent field quantities which exist at trailing edges. The investigation was carried out on a rigid strut with parallel sides and circular leading edge; the strut was not yawed to the flow. Discussions cover broad cases of (1) trailing edges that produce periodic wakes, and (2) trailing edges that produce random wake structures. In each case, the time-averaged, boundary-layer characteristics; streamwise turbulence intensities; and fluctuating surface pressures have been spatially mapped in the region of each edge. Correspondence between surface pressures and turbulent fields in both the immediate vicinity and the far wake of each edge were determined by correlation analyses. Results show a mechanism of pressure production which is common to both random and periodic pressures. They also indicate that the mechanism differs from that which produces attached boundary-layer--wall-pressure fluctuations. GRA

DATA SUMMARY: Measurements of fluctuating pressures on trailing edges of flat struts and of fluctuating velocities in wakes that generate those pressures; variables include phase, frequency, pressure distribution, distance from leading edge, distance from trailing edge, spectral density, turbulent velocity, boundary layer thickness, displacement thickness, momentum thickness, and shape factor; 63 figures and 2 tables include numeric data.

N77-18063# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.

SURVEY OF THREE-DIMENSIONAL FLOW FIELDS IN THE PRESENCE OF WING AT M = 2.48

George S. Pick and Richard M. Hartley Jul. 1976 57 p refs (WF32323203)

(AD-A028981; Aero-1224; DTNSRDC-76-0075) Avail: NTIS HC A04/MF A01 CSCL 20/4

Wind tunnel tests of sting-mounted and a small-mounted model of the generic ordnance ramjet engine vehicle were conducted. Emphasis was placed on the flow field behind movable wing control surfaces. The effects of wing platform, thickness ratio, and deflection angle on total and static pressure and on local Mach number distributions at possible locations for inlet installations were studied. Results include a data base from which it is possible to select inlet locations with acceptable pressure recovery. Author

DATA SUMMARY: Flow field behavior in the wing wake region; variables include wing deflection, thickness ratio, total pressure distribution, static pressure distribution, local Mach number distribution, and wing planform; 19 figures and 4 tables include numeric data.

N77-18064# Massachusetts Inst. of Tech., Cambridge. Gas Turbine Lab.
THREE-DIMENSIONAL COMPRESSIBLE FLOW THROUGH HIGHLY LOADED AXIAL COMPRESSOR BLADE ROWS Interim Report, 15 Nov. 1974 - 14 Nov. 1975
James E. McCune and William R. Hawthorne May 1976 27 p refs
(Grant AF-AFOSR-2784-75; AF Proj. 9781)
(AD-A027784; AFOSR-76-0895TR) Avail: NTIS HC A03/MF A01 CSCL 13/7

Three-dimensional inviscid flows through axial compressor cascades have been analyzed both in rectilinear and annular geometry, using Beltrami flow concepts. Comparison has been made with experimental data available from the M.I.T. Blowdown Compressor Test Facility. Such comparison indicates strongly that certain three-dimensional effects included in this theory are actually present in the real flow and that these may be important in practical design and performance analyses. The new theory is linearized about the nonlinear mean flow, so that large, practical pressure ratios can be included in the analysis. Examples have been given to show that three-dimensional induced-velocity effects can be as important, in highly-loaded transonic ducted fans, as many other effects currently included in engine design codes. This 'quasi-linear' theory also has important implications regarding transonic compressor noise spectra. GRA

DATA SUMMARY: Comparison of the predicted mean downstream radial and axial velocity components associated with the blade loading and experimental data; variables include axial Mach number, sonic radius, radial Mach number, blade passing loads, and pitchwise Mach number; 11 figures include numeric data.

N77-18065# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala.
AERODYNAMIC CHARACTERISTICS OF A SERIES OF BODIES WITH AND WITHOUT TAILS AT MACH NUMBERS FROM 0.8 TO 3.0 AND ANGLES OF ATTACK FROM 0 TO 45 DEGREES
J. N. Derrick, D. J. Spring, and G. C. Winn 16 Jul. 1976 889 p refs
(DA Proj. 1W3-62303-A-214)
(AD-A028324; RD-7T-3) Avail: NTIS HC A99/MF A01 CSCL 20/4

Wind tunnel tests were conducted in a 16 ft. transonic tunnel, a supersonic tunnel, A and a trisonic tunnel to establish a bank of systematic data for body and body-tail configurations at high angles of attack. The configurations were tested at Mach numbers between 0.8 and 3.0, angles of attack from -2 to 45 degrees, and roll angles from 0 to 90 degrees. The aerodynamic characteristics were obtained for the total configuration as well as each of the four undeflected tail fins. GRA

DATA SUMMARY: Wind tunnel tests of model combinations of a tangent ogive nose of 3 calibers attached to cylindrical afterbodies of 7, 8.25, 9.5, and 11.5 calibers with fins of varying planforms installed at the model base at the 0, 90, 180, and 270 degree positions; variables include angle of roll, angle of attack, Mach number, normal force coefficient, side force coefficient, pitching moment coefficient, yawing moment coefficient, axial force coefficient, hinge moment coefficient, and bending moment coefficient; 23 figures and 4 tables include numeric data.

N77-18066# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala.
AN ASSESSMENT OF THE MARTIN-MARIETTA HIGH ANGLE OF ATTACK AERODYNAMIC METHODOLOGY FOR BODY TAIL MISSILES
Donald J. Spring, Jimmie N. Derrick, and Gary C. Winn 28 Jun. 1976 127 p refs
(DA Proj. 1M3-62303-A-214)
(AD-A028053; RD-76-33) Avail: NTIS HC A07/MF A01 CSCL 16/4

An assessment of the validity and range of applicability of the high angle of attack methodology developed by the Martin-Marietta Corporation, Orlando Division, under contract to the Army Missile Command has been carried out. The comparisons with experimental data showed inconsistent results with most of the prediction falling within an average accuracy band of approximately 7.5 percent with a few cases as high as 25 percent. Causes for the deviations as well as areas that warrent further improvements are specified. The methodology is suitable in its current form for preliminary design tradeoff studies.
Author (GRA)

DATA SUMMARY: Calculations for BIT1 through and including BIT3-2; variables include body geometries, fin geometries, normal force coefficient, and center of pressure location; 23 figures and 1 table include numeric data.

N77-18067# Air Force Academy, Colo.
SUBSONIC AERODYNAMIC CHARACTERISTICS OF PROPOSED HIGH WING MANEUVERING AIR-TO-SURFACE SUBMUNITIONS Final Report, Nov. 1975 - May 1976
Frederick M. Jonas Jun. 1976 75 p refs
(AD-A028227; USAFA-TR-76-13; AFATL-TR-76-58) Avail: NTIS HC A04/MF A01 CSCL 16/4

Subsonic aerodynamic and static stability characteristics of proposed high wing mounted Maneuvering Air-to-Surface Submunitions were investigated using 0.5-scale models in the USAFA 2 ft. x 3 ft. Subsonic Wind Tunnel facility. Data were obtained on fourteen configurations at Mach numbers of 0.18, 0.22, or 0.27 and corresponding Reynolds numbers of 230,000, 280,000, or 330,000 based on the average chord. Nominal angle of attack range tested varied from -10 to +15 degrees and angle of sideslip range (at alpha + 0 deg) varied from -15 to +15 degrees. A technique for determining the maximum contribution of wing dihedral to static lateral stability as well as methods for improving aerodynamic efficiency are presented and verified experimentally. All configurations tested were statically stable in pitch, yaw, and roll and the maximum L/D (untrimmed) obtained was 7.45. The results of the investigations may be used as a baseline for other configurations as well as general design guidance. GRA

DATA SUMMARY: Results of subsonic wind tunnel tests performed on a proposed high wing configuration of the maneuvering air to surface submunitions; variables include drag coefficient, lift coefficient, pitching moment coefficient, rolling moment coefficient, yawing moment coefficient, lift-drag ratio, angle of attack, angle of sideslip; 45 figures and 7 tables include numeric data.

N77-18068# Army Electronics Command, Fort Monmouth, N.J.
REDESIGN AND IMPROVEMENT OF BALLOON ML-566 Technical Report, Jan. - Dec. 1975
Moses Sharenow Jun. 1976 16 p refs
(DA Proj. 1S7-64726-D-511)
(AD-A028967; ECOM-5595) Avail: NTIS HC A02/MF A01 CSCL 01/3

Methods of improving the performance of Balloon ML-566 were investigated in an effort to meet the Army's high-reliability requirement. Numerous balloon designs were evaluated. A single-cell natural-rubber latex balloon was found to meet more of the criteria than any of the other designs considered. GRA

DATA SUMMARY: Flight test results for single cell and double cell balloons consisting of neoprene and/or natural rubber, some of which were plasticized; variables include burst altitude, ascent rate to 21 km, ascent rate to bursts; 5 tables include numeric data.

N77-18069# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
NUMERICAL SOLUTION OF THE CONICALLY SYMMETRIC NAVIER-STOKES EQUATIONS FOR HYPERSONIC CONE FLOW AT ANGLE OF ATTACK Ph.D. Thesis
David S. McRae Jul. 1976 116 p refs

(AF Proj. 1929)
(AD-A028351; DS/AE/76-2) Avail: NTIS HC A06/MF A01 CSCL 20/4

Solutions which include the viscous effects present in experiment were obtained for hypersonic flow over sharp cones at high angle of attack by integrating the Navier-Stokes equations subject to a conical symmetry assumption. A physically based technique was demonstrated for controlling starting transients and for reducing or eliminating numerical oscillations occurring at shock discontinuities during the integration. The general features which appeared in experiment are shown to appear in the results of the integration, including the proper behavior, in a laminar flow, of the visous layer and the vortical singularity. The results agree well with the experimental data, except for a discrepancy in pitot pressure in the viscous layer, evident in a small region near a calculated bow shock wave position 27 percent closer to the cone surface at the lee ceterline. It is concluded that the lee side viscous layer discrepancies at both experimental conditions are primarily due to lack of any mechanism in the technique to model the nonconical flow near the nose of the cone. Author

DATA SUMMARY: Comparison of calculated and experimental surface pressure; variables include Mach number, angle of attack, pitot pressure, surface pressure distribution, elevation, distance along cone surface, distance from surface, and circumferential angle; 26 figures include numeric data.

N77-18070# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.
STAGNATION POINT SOLUTION OF VISCOUS SHOCK LAYER EQUATIONS FOR FLOW PAST A SPHERE Final Report, Apr. 1974 - Mar. 1976
B. N. Srivastava, M. J. Werle, and R. T. Davis Aug. 1976 33 p refs
(Contract F40600-74-C-0011)
(AD-A028079; AFL-76-4-20; AEDC-TR-76-53) Avail: NTIS HC A03/MF A01 CSCL 20/4

Numerical solutions in the stagnation region of a spherically blunted body are obtained by using the full and thin layer version of the viscous shock layer equations. The numerical system utilizes an implicit finite difference scheme combined with a relaxation technique for determining the bow shock shape. Comparisons with experimental data are made for shock Reynolds numbers, Re sub s, of 20 to 2000 and Mach numbers of 4 to 20. Both the surface heating levels as well as the shock layer density profiles are presented. It is found that with the inclusion of the shock and body slip, the full viscous shock layer model apparently enjoys a range of validity down to Re sub s of 20 to 30. The thin layer version of these equations are shown to be inadequate for such low Reynolds numbers. Author (GRA)

DATA SUMMARY: Blunt body flow regime in atmospheric reentry; the variables include stagnation point heat transfer, boundary layer flow, shock wave propagation, Stanton number, Reynolds number, stagnation point density profile, and flow transition; 9 figures and no tables.

N77-18071# ARO, Inc., Arnold Air Force Station, Tenn.
ANALYSIS OF THREE-DIMENSIONAL INVISCID SUPERSONIC FLOW BETWEEN A BODY AND AN OUTER WALL WITH APPLICATION TO A JET STRETCHER SYSTEM Final Report, 1 Jul. 1973 - 30 Jun. 1975
W. C. Armstrong and R. C. Bauer AEDC Aug. 1976 98 p refs
(ARO Proj. RF423; ARO Proj. R33P-60A)
(AD-A029123; ARO-ETF-TR-76-27; AEDC-TR-76-103) Avail: NTIS HC A05/MF A01 CSCL 20/4

The three-dimensional inviscid supersonic flow equations are solved for the flow over a body located within a duct. Numerical solutions are obtained by use of the reference plane method of characteristics technique. Results of the analysis are compared with experimental test body pressure distributions obtained with an off-design jet stretcher system. The analysis is sufficiently general so that a variety of internal flows may be predicted. A computer program listing and an example problem are presented. GRA

DATA SUMMARY: Test body pressure distribution was surveyed at 180 deg leeward, 90 deg, and 0 deg windward; variables include model pressure coefficient and inches; 1 figure includes numeric data.

N77-18072# Pratt and Whitney Aircraft, East Hartford, Conn.
ANALYTICAL AND EXPERIMENTAL STUDY OF SUBSONIC STALLED FLUTTER Interim Report, 1 Apr. 1975 - 31 Mar. 1976
R. A. Arnoldi, F. O. Carta, R.-H. Ni, and A. St.Hilaire May 1976 73 p refs
(Contract F44620-75-C-0066; AF Proj. 9781)
(AD-A027869; PWA-5420; AFOSR-76-0829TR) Avail: NTIS HC A04/MF A01 CSCL 21/5

A series of experimental measurements of airfoil pressure distributions were made in an eleven-airfoil oscillating cascade wind tunnel. The airfoils were oscillated in pitch about mid-cord pivots with an amplitude of + or - 2 degrees at tunnel velocities of 100, 150 and 200 feet-per-second, obtaining reduced frequencies in the range of 0.03 to 0.20. Incident air angles were set at 12, 10 and 8 deg; the cascade angle was 30 deg from a fully closed setting; tests were run at interblade phase angles of zero and forty five degrees. A computer program was adapted to calculate oscillating lift and moment coefficients on the assumptions of incompressible flow, flat plate airfoils, fixed separation point, zero pressure amplitude in the separated region and in the wake, and all streamlines parallel to the airfoil surfaces. The calculations were found to give good agreement between theory and experiment for assumptions of separction at 75 percent chord for 45 deg interblade phase and at 85 percent chord at zero phase, independent of reduced frequency and air inlet angle. At 12 deg air inlet angle, the experimental appearance of large effects at twice the oscillation frequency prevented application of the theoretical analysis. The calculated values at zero phase are limits as approached by very small negative phase angles, and differ substantially from calculated values approached from the positive side. The reasons for this discrepancy are not known It is recommended that experimental studies be aimed at a range of moderate phase angles, both positive and negative. GRA

DATA SUMMARY: Pressure transducer sensitivities and least square errors for suction and pressure surfaces; variables include dimensionless time, hot film amplitude, dimensionless chord, time, first harmonic phase, pitching moment coefficient, pitch oscillation, pressure, sensitivity, zero intercept volt, and standard deviation volt; 27 figures and 4 tables include numeric data.

N77-18073# ARO, Inc., Arnold Air Force Station, Tenn.
AERODYNAMIC LOAD CHARACTERISTICS OF SIX 0.05-SCALE STORES IN THE FLOW FIELD OF AN F-4C AIRCRAFT AT MACH NUMBERS FROM 0.5 TO 1.1 Final Report, period ending 20 Nov. 1975
G. R. Gomillion AEDC Aug. 1976 78 p
(AF Proj. 2567)
(AD-A029144; ARO-PWT-TR-76-12; AEDC-TR-76-45; AFATL-TR-76-36) Avail: NTIS HC A05/MF A01 CSCL 20/4

Wind-tunnel tests were conducted using six 0.05-scale stores with various afterbody shapes to investigate the store aerodynamic load characteristics in the flow field of the F-4C aircraft. The store models had a hemispherical nose and a cylindrical midsection with various afterbody shapes. Three store models had cruciform pattern fins on a blunted cone-shaped afterbody. The other three store models had blunted cone, blunted ogive, and cylindrical-shaped afterbodies, respectively. All finned store models were tested in both 'X' and '-' fin orientations. Free-Stream store loads data were also obtained at yaw angles between -6 and 30 deg. All store loads data are presented for Mach numbers from 0.5 to 1.1. Author (GRA)

DATA SUMMARY: Diverse data are presented; variables include Reynolds number, dynamic pressure, Mach number, free stream aerodynamic coefficient, yaw angle, flow field aerodynamic coefficient, and tunnel conditions and coefficients.

N77-18074# Textron, Inc., Buffalo, N.Y. Aerospace Div.
NUMERICAL SOLUTION OF COMPLETE FLOWS AROUND EXTERNAL STORES Interim Report
Z. Popinski and S. W. Zelazny Jun. 1976 65 p refs

(Contract F44620-75-C-0003; AF Proj. 9749)
(AD-A028037; Rept-9236-928001; AFOSR-76-0901TR) Avail: NTIS HC A04/MF A01 CSCL 20/4

A computer code, based on a finite element algorithm, was developed to solve the governing equations for a three-dimenstional flow around a spherically blunted cone at an angle of attack. The solution is valid for a boundary layer region, including the flow separation in the cross-flow direction in the leeward area. The required initial and boundary conditions for this solution are obtained from a finite difference computer program for laminar compressible three-dimensional boundary layer flow. Extension of the analysis to include the turbulent transport using the mixing length theory and a two-equation turbulence model is described. The results demonstrate the capability of the finite element method to predict the three-dimensional boundary region flow with cross-flow separation in the leeward area. GRA

DATA SUMMARY: Numerical prediction of aerodynamic performance characteristics of external stores within their flight envelope by the finite element method; variables include pressure ratio, circumferential angle, height, spherical coordinate system angle, circumferential direction, skin friction distribution, and heat transfer distribution; 11 figures and 2 tables include numeric data.

N77-18075# ARO, Inc., Arnold Air Force Station, Tenn.
FLOW-FIELD CHARACTERISTICS NEAR THE MIDWING WEAPONS PYLON OF THE F-16 AIRCRAFT AT MACH NUMBERS FROM 0.4 TO 0.95
E. G. Allee, Jr. AEDC Aug. 1976 89 p
(AF Proj. 2567; ARO Proj. P41C-A4A)
(AD-A028078; ARO-PWT-TR-76-8; AEDC-TR-76-44; AFATL-TR-76-32) Avail: NTIS HC A05/MF A01 CSCL 20/4

Wind tunnel tests using 0.0667-scale models were conducted to determine the characteristics of the flow field near the midwing weapons pylon (wing stations 3 and 7) of the F-16 aircraft. The investigation was conducted by positioning an MK-84 LDGP store at various locations beneath the pylon, by use of a pressure probe to measure the flow-field velocities and angles relative to the freestream, and by separation trajectories using the MK-84 LDGP launched from the pylon. Test conditions ranged from Mach number 0.4 to 0.95 for aircraft angles of attack from 0 to 16 deg. Wing leading-edge flaps of the F-16 model were set at angles of 0, 4, and 15 deg. All trajectories were obtained at a simulated altitude of 5,000 ft. Author (GRA)

DATA SUMMARY: Wind tunnel tests of scale models of the F-16 aircraft and associated pylons, the MK-84 LDGP bomb, the AIM-9J missile, the 370-gal fuel tank, and the ALQ-119-12 ECM pod; variables include normal force coefficient, side force coefficient, axial force coefficient, Mach number, angle of attack, separation distance, and pylon axis-system coordinates; 11 figures and 3 tables include numeric data.

N77-18076# ARO, Inc., Arnold Air Force Station, Tenn.
EVALUATION OF BOATTAIL GEOMETRY AND EXHAUST PLUME TEMPERATURE EFFECTS ON NOZZLE AFTERBODY DRAG AT TRANSONIC MACH NUMBERS Final Report, Jul. 1974 - Jun. 1975
L. L. Galigher, S. F. Yaros, and R. C. Bauer Oct. 1976 142 p refs
(ARO Proj. PA411; ARO Proj. P41T-80A)
(AD-A030852; ARO-PWT-TR-76-28; AEDC-TR-76-102) Avail: NTIS HC A07/MF A01 CSCL 21/5

An experimental program was conducted to investigate the interaction effects which occur between the nozzle exhaust flow and the external flow field associated with isolated nozzle afterbody configurations at transonic Mach numbers. Pressure data were obtained from three afterbody geometries with boattail angles of 10, 15, and 25 deg at Mach numbers from 0.6 to 1.5 at zero angles of attack and sideslip. Cold (High-pressure air) and hot (Air/ethylene combustion) jet test techniques were used to simulate and duplicate, respectively, the nozzle exhaust flow for a sonic jet installation. Nozzle exhaust temperature was varied from 540 to approximately 2,900 R. The most significant results pertain to those effects on boattail pressure drag caused by exhaust plume temperature and flow asymmetry (Model support strut induced). The differences obtained in boattail pressure drag between the cold jet simulation and hot jet duplication results were significant at nozzle pressure ratios representative for turbofan and turbojet engines at subsonic Mach numbers. Adjusting the cold jet nozzle pressure ratio to correct for changes in the exhaust plume specific heat ratio with temperature did not account for the differences observed. Flow asymmetry effects were Mach number and nozzle pressure ratio dependent and increased in severity as the boattail angle was increased. Author (GRA)

DATA SUMMARY: Wind tunnel cold and hot exhaust testing with three external afterbody configurations having boattail angles of 10, 15, and 25 deg; variables include nozzle total pressure, Reynolds number, nozzle base area, exhaust plume temperature, flow duct total pressure, nozzle pressure ratio, Mach number, flow asymmetry, boattail pressure distribution, and boattail drag coefficient; 30 figures and 3 tables include numeric data.

N77-18077# Air Force Academy, Colo. Frank J. Seiler Research Lab.
AN EXPERIMENTAL INVESTIGATION OF WING TRAILING VORTEX FORMATION Final Report, Jun. 1974 - Aug. 1976
Michael S. Francis Aug. 1976 211 p refs
(AF Proj. 2307)
(AD-A030729; FJSRL-TR-76-0013) Avail: NTIS HC A10/MF A01 CSCL 20/4

The incompressible flowfield in the vicinity of a lifting rectangular finite wing is investigated experimentally to ascertain the nature and detailed characteristics of the formation and early development of a trailing vortex. The apparatus was designed and fabricated to facilitate a direct comparison of real flow data with existing theories and flow models. The inboard potential flow region was observed to exhibit the simplifying characteristic of a spanwise cross-flow velocity component which is independent of the surface normal coordinate. As a result, a possible ambiguity in the determination of the stream-wise vorticity component was removed. Graphs of the near-surface (bound) vorticity distribution are presented along with a map of Prandtl bound vortex filaments. The associated bound circulation function could be expressed approximately as the product of two separable functions of the planform spatial coordinates. Measurements at the wing trailing edge are employed to show that the properly non-dimensionalized characteristic vorticity distribution in this region is independent of angle of attack. GRA

DATA SUMMARY: Diverse data are presented; variables include flow velocity, drag coefficient, lift-drag ratio, percentage of vorticity, electric potential, lift coefficient, angle of attack, spanwise location, chordwise position, circulation.

N77-18078# Polytechnic Inst. of New York, Farmingdale. Dept. of Aerospace Engineering and Applied Mechanics.
WIND TUNNEL EXPERIMENTS ON WAKES IN STRATIFIED FLOW INCLUDING MODELING CRITERIA AND DEVELOPMENT OF EXPERIMENTAL EQUIPMENT Interim Report
Gordon H. Strom Jun. 1976 71 p refs
(Contract N00014-67-A-0438-0017; ARPA Order 2684)
(AD-A030808; POLY-AE/AM-76-11) Avail: NTIS HC A04/MF A01

Wind tunnel experiments were conducted on dimensions of the turbulent wake from an 8 inch disk model in thermally stratified flow. Results were interpreted in terms of densimetric Froude number as the modeling criterion. The substantial agreement with reported hydrodynamic experiments shows the potential for using wind tunnels to study submarine wakes in stratified flow. An additional modeling criterion for vertical density gradient based on momentum flux may be important for momentumless wakes. Development of experimental equipment needed to obtain uniform wind tunnel airstreams at very low speeds with thermal stratification is described. Author (GRA)

DATA SUMMARY: Series of experiments conducted on the wake produced by a disk in stratified and neutral flow; variables include air speed, elevation, horizontal distance from model, vertical distance from model, downstream distance from model, pressure drop, temperature, normalized wake dimensions, and time after wake generation; 15 figures include numeric data.

N77-18079# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN EXPERIMENTAL INVESTIGATION OF THE EFFECTS OF PLANFORM AND THICKNESS DISCONTINUITIES ON THE AERODYNAMIC CHARACTERISTICS OF A FAMILY OF LOW ASPECT RATIO WINGS M.S. Thesis
Roger D. Hartman Sep. 1976 124 p refs
(AD-A029662; GAE/AE/765-1) Avail: NTIS HC A06/MF A01 CSCL 01/1

An experimental investigation to determine the aerodynamic coefficients of a family of symmetric wing planforms with abrupt planform and thickness discontinuities was conducted. The wing consists of a rectangular center panel with two small, tapered outboard panels. Six different pairs of outboard panels attached to the center panel at different locations were tested. Wind tunnel tests were conducted at Reynolds numbers between 1,740,000 and 1,990,000 and Mach numbers of approximately 0.13. Aspect ratios were between 0.875 and 2.290 The lift curve slopes increase at high angles of attack for small and intermediate outboard panel configurations, suggesting vortex lift due to the low aspect ratio center panel. Drag polars are parabolic except over ranges of angle of attack where outboard panel stall overrides center panel vortex lift. The pitching moment about the center panel quarter chord is near zero for outboard panels mounted at the position, becoming nose down as the outboard panels move aft. Fore and aft shifting of the outboard panels had little effect on C(l), C(d), and lift-to-drag ratio. A vortex lattice analysis consistently predicted C(l) and C(m) well, but predicted induced drag poorly. Author (GRA)

DATA SUMMARY: Diverse data are presented; the variables include planform diagrams, root chord, incidence, wing span, drag coefficient, lift coefficient, lift drag ratio, moment coefficient, low aspect ratio, and Reynolds number.

N77-18080# ARO, Inc., Arnold Air Force Station, Tenn.
A DIRECT COMPARISON OF ANALYTICAL AND EXPERIMENTAL SURFACE AND FLOW-FIELD DATA ON A 4-DEG CONE AT INCIDENCE IN A HYPERSONIC STREAM WITH LAMINAR BOUNDARY LAYERS Final Report
D. E. Boylan, W. T. Strike, and F. L. Shope AEDC Aug. 1976 39 p refs
(AF Proj. 627A; ARO Proj. V43A-02A; ARO Proj. V32A-25A; ARO Proj. V33P-04A)
(AD-A029367; ARO-VKF-TR-76-22; AEDC-TR-76-84) Avail: NTIS HC A03/MF A01 CSCL 20/4

A wind tunnel investigation was conducted in the AEDC Hypersonic Wind Tunnel (C) at Mach numbers near 10 using a 4-deg half-angle cone to study lee side flow-field properties and surface pressures at angles of attack up to about 10 deg. The objective of the study was to provide data to aid in the development of a three-dimensional, hypersonic, viscous shock layer computer code capable of accurately predicting the static stability characteristics of slender bodies at incidence. The results of the present investigation indicate that additional development of the computer code in question is required to fulfill this objective. Author (GRA)

DATA SUMMARY: Hypersonic flow field properties and surface pressures on half angle cone; the variables include static pressure, incidence, aerodynamic force, surface pressure, pressure distribution, boundary layer flow, temperature gradients, Mach number, wall pressure, and flow velocity; 11 figures and 3 tables.

N77-17999*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ADVANCED SURFACE PANELING METHOD FOR SUBSONIC AND SUPERSONIC FLOW
Larry L. Erickson, Forrester T. Johnson (Boeing Commercial Airplane Co., Seattle), and F. Edward Ehlers (Boeing Commercial Airplane Co., Seattle) *In its* Proc. of the SCAR Conf., Part 1 1976 p 25-54 refs (For primary document see N77-17996 09-01)
(Contract NAS2-7729)
Avail: NTIS HC A21/MF A01 CSCL 01A

N77-18000*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DEVELOPMENT OF AN AERODYNAMIC THEORY CAPABLE OF PREDICTING SURFACE LOADS ON SLENDER WINGS WITH VORTEX FLOW
Blair B. Gloss and Forrester T. Johnson (Boeing Commercial Airplane Co., Seattle) *In its* Proc. of the SCAR Conf., Part 1 1976 p 55-68 refs (For primary document see N77-17996 09-01)
Avail: NTIS HC A21/MF A01 CSCL 01A

N77-18002*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THEORETICAL AND EXPERIMENTAL PRESSURE DISTRIBUTIONS FOR A 71.2 DEGREE SWEPT ARROW-WING CONFIGURATION AT SUBSONIC, TRANSONIC, AND SUPERSONIC SPEEDS
Percy J. Bobbitt and Marjorie E. Manroe (Boeing Commercial Airplane Co., Seattle) *In its* Proc. of the SCAR Conf., Part 1 1976 p 85-122 refs (For primary document see N77-17996 09-01)
Avail: NTIS HC A21/MF A01 CSCL 01A

N77-18003*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RESULTS OF RECENT NASA RESEARCH ON LOW-SPEED AERODYNAMIC CHARACTERISTICS OF SUPERSONIC CRUISE AIRCRAFT
Paul L. Coe, Jr. and A. B. Graham (Old Dominion Univ.) *In its* Proc. of the SCAR Conf., Part 1 1976 p 123-135 refs (For primary document see N77-17996 09-01)
Avail: NTIS HC A21/MF A01 CSCL 01A

N77-18004*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
UPPER SURFACE NACELLE INFLUENCE ON SCAR AERODYNAMIC CHARACTERISTICS AT TRANSONIC SPEEDS
Charles E. Mercer and George T. Carson, Jr. *In its* Proc. of the SCAR Conf., Part 1 1976 p 137-154 refs (For primary document see N77-17996 09-01)
Avail: NTIS HC A21/MF A01 CSCL 01A

N77-18005*# McDonnell-Douglas Corp., St. Louis, Mo.
AERODYNAMIC VALIDATION OF A SCAR DESIGN
Robert L. Roensch *In* NASA. Langley Res. Center Proc. of the Scar Conf., Part 1 1976 p 155-168 refs (For primary document see N77-17996 09-01)
(Contract NAS1-13633)
Avail: NTIS HC A21/MF A01 CSCL 01A

N77-18031*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DEVELOPMENTS IN STEADY AND UNSTEADY AERODYNAMICS FOR USE IN AEROELASTIC ANALYSIS AND DESIGN
E. Carson Yates, Jr. and Samuel R. Bland *In its* Proc. of the SCAR Conf., Pt. 2, 1976 31 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01A

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N77-18081*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AIRCRAFT SAFETY AND OPERATING PROBLEMS
1976 644 p refs Conf. Proc. held at Hampton, Va., 18-20 Oct. 1976
(NASA-SP-416) Avail: NTIS HC A99/MF A01 CSCL 01C

Results of NASA research in the field of aircraft safety and operating problems are discussed. Topics include: (1) terminal area operations, (2) flight dynamics and control; (3) ground operations; (4) atmospheric environment; (5) structures and materials; (6) powerplants; (7) noise; and (8) human factors engineering. For individual titles, see N77-18082 through N77-18116.

N77-18082*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

REVIEW OF OPERATIONAL ASPECTS OF INITIAL EXPERIMENTS UTILIZING THE U.S. MLS

Thomas M. Walsh, Samuel A. Morello, and John P. Reeder *In its* Aircraft Safety and Operating Problems 1976 p 3-30 refs (For primary document see N77-18081 09-03)

Avail: NTIS HC A99/MF A01 CSCL 01C

An exercise to support the Federal Aviation Administration in demonstrating the U.S. candidate for an international microwave landing system (MLS) was conducted by NASA. During this demonstration the MLS was utilized to provide the TCV Boeing 737 research airplane with guidance for automatic control during transition from conventional RNAV to MLS RNAV in curved, descending flight; flare; touchdown; and roll-out. Flight profiles, system configuration, displays, and operating procedures used in the demonstration are described, and preliminary results of flight data analysis are discussed. Recent experiences with manually controlled flight in the NAFEC MLS environment are also discussed. The demonstration shows that in automatic three-dimensional flight, the volumetric signal coverage of the MLS can be exploited to enable a commercial carrier class airplane to perform complex curved, descending paths with precision turns into short final approaches terminating in landing and roll-out, even when subjected to strong and gusty tail and cross wind components and severe wind shear. Author

N77-18083*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

OPERATIONAL EXPERIENCE WITH A POWERED-LIFT STOL AIRCRAFT

Robert C. Innis and Hervey C. Quigley *In its* Aircraft Safety and Operating Problems 1976 p 31-42 ref (For primary document see N77-18081 09-03)

Avail: NTIS HC A99/MF A01 CSCL 01C

The experience gained in over four years of STOL operations with the augmentor wing research aircraft and the background of operation of other STOL powered-lift aircraft indicate that the use and percent of lift achieved by powered lift have significant effects on the operational characteristics of STOL aircraft and, therefore, on the performance that can be achieved. A brief description of the augmentor wing including the means by which it achieves its powered lift is presented. Specific problem areas relating to the control of longitudinal flight path are discussed as well as the consequences these might have on the design and operation of this class of aircraft. Particular emphasis is given to the approach and landing phase of flight where the consequences of the powered lift are most pronounced, and the resultant characteristics most different from those of conventional aircraft. Author

N77-18084*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

FLIGHT EVALUATION OF ADVANCED FLIGHT CONTROL SYSTEMS AND COCKPIT DISPLAYS FOR POWERED-LIFT STOL AIRCRAFT

James A. Franklin, Donald W. Smith, DeLamar M. Watson, David N. Warner, Jr., Robert C. Innis, and Gordon H. Hardy *In its* Aircraft Safety and Operating Problems 1976 p 43-62 refs (For primary document see N77-18081 09-03)

Avail: NTIS HC A99/MF A01 CSCL 01C

A flight research program was conducted to assess the improvements, in longitudinal path control during a STOL approach and landing, that can be achieved with manual and automatic control system concepts and cockpit displays with various degrees of complexity. NASA-Ames powered-lift Augmentor Wing Research Aircraft was used in the research program. Satisfactory flying qualities were demonstrated for selected stabilization and command augmentation systems and flight director combinations. The ability of the pilot to perform precise landings at low touchdown sink rates with a gentle flare maneuver was also achieved. The path-control improvement is considered to be applicable to other powered-lift aircraft configurations. Author

N77-18085*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

FACTORS INFLUENCING TOLERANCE TO WIND SHEARS IN LANDING APPROACH

Richard S. Bray *In its* Aircraft Safety and Operating Problems 1976 p 63-76 refs (For primary document see N77-18081 09-03)

Avail: NTIS HC A99/MF A01 CSCL 01C

Flight simulator studies were conducted to examine the piloting problems resulting from encounters with unusual atmospheric disturbances late in landing approach. Simulated encounters with disturbances, including examples derived from accident data, provided the opportunity to study aircraft and pilot performance. It was observed that substantial delays in pilot response to shear-induced departures from glide slope often seriously amplified the consequences of the encounter. In preliminary assessments, an integrated flight instrument display featuring flight path as the primary controlled element appeared to provide the means to minimize such delays by improving tolerance to disturbances in landing approaches. Author

N77-18086*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

DELAYED FLAP APPROACH PROCEDURES FOR NOISE ABATEMENT AND FUEL CONSERVATION

Fred G. Edwards, John S. Bull, John D. Foster, Daniel M. Hegarty, and Fred J. Drinkwater, III *In its* Aircraft Safety and Operating Problems 1976 p 77-90 refs (For primary document see N77-18081 09-03)

Avail: NTIS HC A99/MF A01 CSCL 01C

The NASA/Ames Research Center is currently investigating the delayed flap approach during which pilot actions are determined and prescribed by an onboard digital computer. The onboard digital computer determines the proper timing for the deployment of the landing gear and flaps based on the existing winds and airplane gross weight. Advisory commands are displayed to the pilot. The approach is flown along the conventional ILS glide slope but is initiated at a higher airspeed and in a clean aircraft configuration that allows for low thrust and results in reduced noise and fuel consumption. Topics discussed include operational procedures, pilot acceptability of these procedures, and fuel/noise benefits resulting from flight tests and simulation. Author

N77-18087*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.

GENERAL AVIATION APPROACH AND LANDING PRACTICES

Loyd C. Parker and Maxwell W. Goode (NASA Langley Res. Center, Hampton, Va.) *In its* Aircraft Safety and Operating Problems 1976 p 91-120 refs (For primary document see N77-18081 09-03)

Avail: NTIS HC A99/MF A01 CSCL 01C

The characteristics of air traffic patterns at uncontrolled airports and techniques used by a group of general aviation pilots in landing light airplanes are documented. The results of some 1,600 radar tracks taken at four uncontrolled airports and some 600 landings made by 22 pilots in two, four place, single engine light airplanes show that the uncontrolled traffic pattern is highly variable. The altitudes, distances, and piloting procedures utilized may affect the ability for pilots to see-and-avoid in this environment. Most landing approaches were conducted at an airspeed above recommended, resulting in significant floating during flare and touchdowns that were relatively flat and often nose-low. Author

N77-18088*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.

FLIGHT TEST EVALUATION OF A SEPARATE SURFACE ATTITUDE COMMAND CONTROL SYSTEM ON A BEECH 99 AIRPLANE

Shu W. Gee (Kansas Univ., Lawrence), Gerald E. Jenks, Jan Roskam (Kansas Univ., Lawrence), and Robert L. Stone (Beech Aircraft Corp., Wichita, Kansas) *In its* Aircraft Safety and Operating

Problems 1976 p 121-146 refs (For primary document see N77-18081 09-03)
Avail: NTIS HC A99/MF A01 CSCL 01C

A joint NASA/university/industry program was conducted to flight evaluate a potentially low cost separate surface implementation of attitude command in a Beech 99 airplane. Saturation of the separate surfaces was the primary cause of many problems during development. Six experienced professional pilots who made simulated instrument flight evaluations experienced improvements in airplane handling qualities in the presence of turbulence and a reduction in pilot workload. For ride quality, quantitative data show that the attitude command control system results in all cases of airplane motion being removed from the uncomfortable ride region. Author

N77-18089*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
A REVIEW OF SUPERSONIC CRUISE FLIGHT PATH CONTROL EXPERIENCE WITH THE YF-12 AIRCRAFT
Donald T. Berry and Glenn B. Gilyard *In its* Aircraft Safety and Operating Problems 1976 p 147-164 refs (For primary document see N77-18081 09-03)
Avail: NTIS HC A99/MF A01 CSCL 01C

Flight research with the YF-12 aircraft indicates that solutions to many handling qualities problems of supersonic cruise are at hand. Airframe/propulsion system interactions in the Dutch roll mode can be alleviated by the use of passive filters or additional feedback loops in the propulsion and flight control systems. Mach and altitude excursions due to atmospheric temperature fluctuations can be minimized by the use of a cruise autothrottle. Autopilot instabilities in the altitude hold mode have been traced to angle of attack-sensitive static ports on the compensated nose boom. For the YF-12, the feedback of high-passed pitch rate to the autopilot resolves this problem. Manual flight path control is significantly improved by the use of an inertial rate of climb display in the cockpit. Author

N77-18090*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TENTATIVE CIVIL AIRWORTHINESS FLIGHT CRITERIA FOR POWERED-LIFT TRANSPORTS
Charles S. Hynes and Barry C. Scott (FAA, Ames Res. Center) *In its* Aircraft Safety and Operating Problems 1976 p 165-178 refs (For primary document see N77-18081 09-03)
Avail: NTIS HC A99/MF A01 CSCL 01C

Representatives of the U.S., British, French, and Canadian airworthiness authorities participated in a NASA/FAA program to formulate tentative civil airworthiness flight criteria for powered-lift transports. The ultimate limits of the flight envelope are defined by boundaries in the airspeed/path-angle plane. Angle of attack and airspeed margins applied to these ultimate limits provide protection against both atmospheric disturbances and disturbances resulting from pilot actions or system variability, but do not ensure maneuvering capability directly, as the 30% speed margin does for conventional transports. Separate criteria provide for direct demonstration of adequate capability for approach path control, flare and landing, and for go-around. Demonstration maneuvers are proposed, and appropriate abuses and failures are suggested. Taken together, these criteria should permit selection of appropriate operating points within the flight envelopes for the approach, landing, and go-around flight phases which are likely to be most critical for powered-lift aircraft. Author

N77-18091*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ACCIDENT INVESTIGATION: ANALYSIS OF AIRCRAFT MOTIONS FROM ATC RADAR RECORDINGS
Rodney C. Wingrove *In its* Aircraft Safety and Operating Problems 1976 p 179-190 refs (For primary document see N77-18081 09-03)
Avail: NTIS HC A99/MF A01 CSCL 01C

A technique was developed for deriving time histories of an aircraft's motion from air traffic control (ATC) radar records. This technique uses the radar range and azimuth data, along with the downlinked altitude data (from an onboard Mode-C transponder), to derive an expanded set of data which includes airspeed, lift, thrust-drag, attitude angles (pitch, roll, and heading), etc. This method of analyzing aircraft motions was evaluated through flight experiments which used the CV-990 research aircraft and recordings from both the enroute and terminal ATC radar systems. The results indicate that the values derived from the ATC radar records are for the most part in good agreement with the corresponding values obtained from airborne measurements. In an actual accident, this analysis of ATC radar records can complement the flight-data recorders, now onboard airliners, and provide a source of recorded information for other types of aircraft that are equipped with Mode-C transponders but not with onboard recorders. Author

N77-18092*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STATUS OF RUNWAY SLIPPERINESS RESEARCH
Walter B. Horne *In its* Aircraft Safety and Operating Problems 1976 p 191-246 refs (For primary document see N77-18081 09-03)
Avail: NTIS HC A99/MF A01 CSCL 01C

Runway slipperiness research performed in the United States and Europe since 1968 is reviewed. Topics discussed include: (1) runway flooding during rainstorms; (2) hydroplaning; (3) identification of slippery runways including the results from ground vehicle friction measurements and attempts to correlate these measurements with aircraft stopping performance; (4) progress and problems associated with the development of antihydroplaning runway surface treatments such as pavement grooving and porous friction course (PFC); and (5) runway rubber deposits and their removal. Author

N77-18093*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DEVELOPMENTS IN NEW AIRCRAFT TIRE TREAD MATERIALS
Thomas J. Yager, John L. McCarty, S. R. Riccitiello (NASA Ames Res. Center, Moffett Field, Calif.), and M. A. Golub (NASA Ames Res. Center, Moffett Field, Calif.) *In its* Aircraft Safety and Operating Problems 1976 p 247-256 (For primary document see N77-18081 09-03)
Avail: NTIS HC A99/MF A01 CSCL 01C

Comparative laboratory and field tests were conducted on experimental and state-of-the-art aircraft tire tread materials in a program aimed at seeking new elastomeric materials which would provide improved aircraft tire tread wear, traction, and blowout resistance in the interests of operational safety and economy. The experimental stock was formulated of natural rubber and amorphous vinyl polybutadiene to provide high thermal-oxidative resistance, a characteristic pursued on the premise that thermal oxidation is involved both in the normal abrasion or wear of tire treads and probably in the chain of events leading to blowout failures. Results from the tests demonstrate that the experimental stock provided better heat buildup (hysteresis) and fatigue properties, at least equal wet and dry traction, and greater wear resistance than the state-of-the-art stock. Author

N77-18094*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STATUS OF RECENT AIRCRAFT BRAKING AND CORNERING RESEARCH
Sandy M. Stubbs and John A. Tanner *In its* Aircraft Safety and Operating Problems 1976 p 257-270 ref (For primary document see N77-18081 09-03)
Avail: NTIS HC A99/MF A01 CSCL 01C

The sources of degraded performance which sometimes occurs under adverse runway conditions, are investigated to obtain data necessary to the development of more advanced systems, in an effort to insure safe ground handling operations under all-weather conditions. Tire-to-ground friction characteristics are determined under braking conditions which closely resemble those of airplanes under heavy braking. Braking data from single-wheel landing loads track tests are related with those available from full-scale flight tests. Author

N77-18095*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ATMOSPHERIC TURBULENCE POWER SPECTRAL MEASUREMENTS TO LONG WAVELENGTHS FOR SEVERAL

METEOROLOGICAL CONDITIONS
Richard H. Rhyne, Harold N. Murrow, and Kenneth Sidwell (George Washington Univ., Washington, D.C.) *In its* Aircraft Safety and Operating Problems 1976 p 271-286 refs (For primary document see N77-18081 09-03)
Avail: NTIS HC A99/MF A01 CSCL 04B

Use of power spectral design techniques for supersonic transports requires accurate definition of atmospheric turbulence in the long wavelength region below the knee of the power spectral density function curve. Examples are given of data obtained from a current turbulence flight sampling program. These samples are categorized as (1) convective, (2) wind shear, (3) rotor, and (4) mountain-wave turbulence. Time histories, altitudes, root-mean-square values, statistical degrees of freedom, power spectra, and integral scale values are shown and discussed. Author

N77-18096*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LASER DOPPLER TECHNOLOGY APPLIED TO ATMOSPHERIC ENVIRONMENTAL OPERATING PROBLEMS
Edwin A. Weaver, James W. Bilbro, James A. Dunkin, and Harold B. Jeffreys *In its* Aircraft Safety and Operating Problems 1976 p 287-302 refs (For primary document see N77-18081 09-03)
Avail: NTIS HC A99/MF A01 CSCL 04B

Carbon dioxide laser Doppler ground wind data were very favorably compared with data from standard anemometers. As a result of these measurements, two breadboard systems were developed for taking research data: a continuous wave velocimeter and a pulsed Doppler system. The scanning continuous wave laser Doppler velocimeter developed for detecting, tracking and measuring aircraft wake vortices was successfully tested at an airport where it located vortices to an accuracy of 3 meters at a range of 150 meters. The airborne pulsed laser Doppler system was developed to detect and measure clear air turbulence (CAT). This system was tested aboard an aircraft, but jet stream CAT was not encountered. However, low altitude turbulence in cumulus clouds near a mountain range was detected by the system and encountered by the aircraft at the predicted time. Author

N77-18097*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUMMARY OF NASA WAKE-VORTEX MINIMIZATION RESEARCH
R. Earl Dunham, Jr. *In its* Aircraft Safety and Operating Problems 1976 p 303-318 refs (For primary document see N77-18081 09-03)
Avail: NTIS HC A99/MF A01 CSCL 01A

NASA's effort in the area of wake-vortex minimization are reviewed. The results presented at a NASA symposium on wake-vortex minimization are summarized and additional results obtained since the symposium are included. Theoretical and experimental techniques for assessing the effectiveness of various wake-vortex minimization techniques are described. Three methods of reducing the effect of aircraft trailing vortices and a preliminary assessment of the operational suitability of employing wake-vortex minimization techniques are discussed. The application of one wake-vortex minimization technique to DC-10 and L-1011 aircraft is presented. Author

N77-18098*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STATUS OF NASA AIRCRAFT ENGINE EMISSION REDUCTION AND UPPER ATMOSPHERE MEASUREMENT PROGRAMS
Richard A. Rudey and Erwin A. Lezberg *In its* Aircraft Safety and Operating Problems 1976 p 319-336 refs (For primary document see N77-18081 09-03)
Avail: NTIS HC A99/MF A01 CSCL 21E

Advanced emission reduction techniques for five existing aircraft gas turbine engines are evaluated. Progress made toward meeting the 1979 EPA standards in rig tests of combustors for the five engines is reported. Results of fundamental combustion studies suggest the possibility of a new generation of jet engine combustor technology that would reduce oxides-of-nitrogen (NOx) emissions far below levels currently demonstrated in the engine-related programs. The Global Air Sampling Program (GAS) is now in full operation and is providing data on constituent measurements of ozone and other minor upper-atmosphere species related to aircraft emissions. Author

N77-18099*# General Electric Co., New York.
STATUS OF RESEARCH INTO LIGHTNING EFFECTS ON AIRCRAFT
J. A. Plumer *In* NASA. Langley Res. Center Aircraft Safety and Operating Problems 1976 p 337-354 refs (For primary document see N77-18081 09-03)
Avail: NTIS HC A99/MF A01 CSCL 01C

Developments in aircraft lightning protection since 1938 are reviewed. Potential lightning problems resulting from present trends toward the use of electronic controls and composite structures are discussed, along with presently available lightning test procedures for problem assessment. The validity of some procedures is being questioned because of pessimistic results and design implications. An in-flight measurement program is needed to provide statistics on lightning severity at flight altitudes and to enable more realistic tests, and operators are urged to supply researchers with more details on electronic components damaged by lightning strikes. A need for review of certain aspects of fuel system vulnerability is indicated by several recent accidents, and specific areas for examination are identified. New educational materials and standardization activities are also noted. Author

N77-18100*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RATIONALE FOR STRUCTURAL INSPECTIONS
John R. Davidson *In its* Aircraft Safety and Operating Problems 1976 p 355-368 refs (For primary document see N77-18081 09-03)
Avail: NTIS HC A99/MF A01 CSCL 14D

The methods developed to predict the reliability of aircraft structures depend upon inspection effectiveness which, in turn, depends upon structural complexity, quality, and the percentage of the structure inspected. Reliability can be enhanced by choosing materials properly, designing damage-tolerant structures, and increasing inspection frequency. And, for fleet operations, costs can be minimized through proper inspection schedules, and enhanced reliability can be compatible with minimum cost. The methods are derived from a combination of probability theory and engineering equations. A discussion of these methods is presented. Author

N77-18101*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GENERAL AVIATION CRASH SAFETY PROGRAM AT LANGLEY RESEARCH CENTER
Robert G. Thomson *In its* Aircraft Safety and Operating Problems 1976 p 369-390 refs (For primary document see N77-18081 09-03)
Avail: NTIS HC A99/MF A01 CSCL 01C

The purpose of the crash safety program is to support development of the technology to define and demonstrate new structural concepts for improved crash safety and occupant survivability in general aviation aircraft. The program involves three basic areas of research: full-scale crash simulation testing, nonlinear structural analyses necessary to predict failure modes and collapse mechanisms of the vehicle, and evaluation of energy absorption concepts for specific component design. Both analytical and experimental methods are being used to develop expertise in these areas. Analyses include both simplified procedures for estimating energy absorption capabilities and more complex computer programs for analysis of general airframe response. Full-scale tests of typical structures as well as tests on structural components are being used to verify the analyses and to demonstrate improved design concepts. Author

N77-18102*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MATERIALS RESEARCH FOR AIRCRAFT FIRE SAFETY
Demetrius A. Kourtides, John A. Parker, and Richard W. Bricker (NASA Johnson Space Center) *In its* Aircraft Safety and Operating Problems 1976 p 391-422 refs (For primary document see N77-18081 09-03)
Avail: NTIS HC A99/MF A01 CSCL 01C

The thermochemical and flammability characteristics of two

polymeric composites currently in use and seven others being considered for use as aircraft interior panels are described. The properties studied included: (1) limiting oxygen index of the composite constituents; (2) fire containment capability of the composite; (3) smoke evolution from the composite; (4) thermogravimetric analysis; (5) composition of the volatile products of thermal degradation; and (6) relative toxicity of the volatile products of pyrolysis. The performance of high-temperature laminating resins such as bismaleimides is compared with the performance of phenolics and epoxies. The relationship of increased fire safety with the use of polymers with high anaerobic char yield is shown. Processing parameters of the state-of-the-art and the advanced bismaleimide composites are detailed. Author

N77-18103*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CONCEPTS FOR IMPROVING TURBINE DISK INTEGRITY

Albert Kaufman *In its* Aircraft Safety and Operating Problems 1976 p 423-442 refs (For primary document see N77-18081 09-03)

Avail: NTIS HC A99/MF A01 CSCL 21E

Advanced disk structural concepts are used to improve the cyclic lives and reliability of turbine disks. Analytical studies were conducted to evaluate bore-entry disks as potential replacements for the existing first-stage turbine disks in the CF6-50 and JT8D-17 engines. Results of low-cycle fatigue, burst, fracture mechanics, and fragment energy analyses are summarized for the advanced disk designs and the existing disk designs with both conventional and advanced disk materials. Other disk concepts such as composite, laminated, link, multibore, multidisk, and spline disks were also evaluated for the CF6-50 engine. Author

N77-18104*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

AIRCRAFT ENGINE SUMP-FIRE STUDIES

William R. Loomis *In its* Aircraft Safety and Operating Problems 1976 p 443-456 refs (For primary document see N77-18081 09-03)

Avail: NTIS HC A99/MF A01 CSCL 21E

Results of ongoing experimental studies are reported in which a 125-millimeter-diameter-advanced-bearing test rig simulating an engine sump is being used to find the critical range of conditions for fires to occur. Design, material, and operating concepts and techniques are being studied with the objective of minimizing the problem. It has been found that the vapor temperature near a spark ignitor is most important in determining ignition potential. At temperatures producing oil vapor pressures below or much above the calculated flammability limits, fires have not been ignited. But fires have been routinely started within the theoretical flammability range. This indicates that generalizing the sump-fire problem may make it amenable to analysis, with the potential for realistic solutions. Author

N77-18105*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ALTERNATIVE AIRCRAFT FUELS TECHNOLOGY

Jack Grobman *In its* Aircraft Safety and Operating Problems 1976 p 457-468 refs (For primary document see N77-18081 09-03)

Avail: NTIS HC A99/MF A01 CSCL 21D

NASA is studying the characteristics of future aircraft fuels produced from either petroleum or nonpetroleum sources such as oil shale or coal. These future hydrocarbon based fuels may have chemical and physical properties that are different from present aviation turbine fuels. This research is aimed at determining what those characteristics may be, how present aircraft and engine components and materials would be affected by fuel specification changes, and what changes in both aircraft and engine design would be required to utilize these future fuels without sacrificing performance, reliability, or safety. This fuels technology program was organized to include both in-house and contract research on the synthesis and characterization of fuels, component evaluations of combustors, turbines, and fuel systems, and, eventually, full-scale engine demonstrations. A review of the various elements of the program and significant results obtained so far are presented. Author

N77-18106*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

GAS-PATH SEAL TECHNOLOGY

John Zuk *In its* Aircraft Safety and Operating Problems 1976 p 469-480 refs (For primary document see N77-18081 09-03)

Avail: NTIS HC A99/MF A01 CSCL 11A

Improved gas-path seals are needed for better fuel economy, longer performance retention, and lower maintenance, particularly in advanced, high-performance gas turbine engines. Problems encountered in gas-path sealing are described, as well as new blade-tip sealing approaches for high-pressure compressors and turbines. These include a lubricant coating for conventional, porous-metal, rub-strip materials used in compressors. An improved hot-press metal alloy shows promise to increase the operating surface temperatures of high-pressure-turbine, blade-tip seals to 1450 K (2150 F). Three ceramic seal materials are also described that have the potential to allow much higher gas-path surface operating temperatures than are possible with metal systems. Author

N77-18107*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

ADVANCED INLET DUCT NOISE REDUCTION CONCEPTS

David Chestnutt and Charles E. Feiler (NASA Lewis Res. Center) *In its* Aircraft Safety and Operating Problems 1976 p 481-496 refs (For primary document see N77-18081 09-03)

Avail: NTIS HC A99/MF A01 CSCL 01C

A progress report is given on the implications of inlet noise reduction on aircraft direct operating costs (DOC). It considers treated inlet rings, various other inlet noise reduction concepts, and forward-speed effects. The report was limited to relatively well-established approaches to inlet noise reduction, such as acoustic liners and fixed-geometry/high-subsonic-speed inlets which are the focus of considerable current research activity. All of the concepts discussed are of a 'passive' nature, i.e., no moving parts or electrical feedback systems. Author

N77-18108*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DEVELOPMENTS IN AIRCRAFT JET NOISE TECHNOLOGY

Orlando A. Gutierrez and James R. Stone *In its* Aircraft Safety and Operating Problems 1976 p 497-512 refs (For primary document see N77-18081 09-03)

Avail: NTIS HC A99/MF A01 CSCL 20A

Significant developments in two areas of jet noise technology are described: the development of jet noise technology relative to coannular nozzles of all types, and a recent approach to the analysis of flight effects that appears to allow simulated flight effects results to be transformed to actual flight conditions with a high degree of confidence. The coannular nozzle section presents results applicable to high-bypass-ratio turbofan engines, as well as current work on inverted-profile coannular nozzles applicable to low-bypass-ratio turbofan engines suitable for use in future supersonic cruise aircraft. Author

N77-18109*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EFFECTS OF AIRCRAFT NOISE ON FLIGHT AND GROUND STRUCTURES

John S. Mixson, William H. Mayes, and Conrad M. Willis *In its* Aircraft Safety and Operating Problems 1976 p 513-526 refs (For primary document see N77-18081 09-03)

Avail: NTIS HC A99/MF A01 CSCL 13M

Acoustic loads measured on jet-powered STOL configurations are presented for externally blown and upper surface blown flap models ranging in size from a small laboratory model up to a full-scale aircraft model. The implications of the measured loads for potential acoustic fatigue and cabin noise are discussed. Noise transmission characteristics of light aircraft structures are presented. The relative importance of noise transmission paths, such as fuselage sidewall and primary structure, is estimated. Acceleration responses of a historic building and a residential home are presented for flyover noise from subsonic and supersonic aircraft. Possible effects on occupant comfort are assessed. The results from these three examples show that aircraft noise can induce structural responses that are large enough to require consideration in the design or operation of the aircraft. Author

N77-18110*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AIRFRAME NOISE: A DESIGN AND OPERATING PROBLEM
Jay C. Hardin *In its* Aircraft Safety and Operating Problems 1976 p 527-550 refs (For primary document see N77-18081 09-03)
Avail: NTIS HC A99/MF A01 CSCL 20A

A critical assessment of the state of the art in airframe noise is presented. Full-scale data on the intensity, spectra, and directivity of this noise source are evaluated in light of the comprehensive theory developed by Ffowcs Williams and Hawkings. Vibration of panels on the aircraft is identified as a possible additional source of airframe noise. The present understanding and methods for prediction of other component sources - airfoils, struts, and cavities - are discussed. Operating problems associated with airframe noise as well as potential design methods for airframe noise reduction are identified.
Author

N77-18111*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INSIGHTS INTO THE NATURE AND CONTROL OF ROTOR NOISE
Robert J. Peŏg *In its* Aircraft Safety and Operating Problems 1976 p 551-562 refs (For primary document see N77-18081 09-03)
Avail: NTIS HC A99/MF A01 CSCL 20A

The dynamics of four important farfield rotating blade noise sources are summarized and techniques for noise reduction are discussed. These four noise areas include the role of unsteady blade surface loads on rotational noise, the effect of turbulent inflow on the radiated broadband noise of an airfoil, the influence of the trailing vortex on impulsive noise and tail rotor noise, and the effect of blade geometry on high-speed impulsive noise. These noise mechanisms occur to varying degrees on both helicopter rotors and propellers. Considerable theoretical work was done in the area of high-speed impulsive noise resulting from the geometry of the rotating blade system. Both model and full-scale experimental correlation of helicopter and propeller high-speed noise are presented. The effect of blade number and airfoil thickness distribution in reducing the high-speed noise is shown.
Author

N77-18112*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PASSENGER RIDE COMFORT TECHNOLOGY FOR TRANSPORT AIRCRAFT SITUATIONS
D. William Conner and Ira D. Jacobsen (Va. Univ.) *In its* Aircraft Safety and Operating Problems 1976 p 563-584 refs (For primary document see N77-18081 09-03)
Avail: NTIS HC A99/MF A01 CSCL 05E

A brief overview is given of NASA research in ride comfort and of the resultant technology. Three useful relations derived from the technology are presented together with five applications of these relations to illustrate their effectiveness in addressing various ride comfort situations of passenger transports.
Author

N77-18113*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
RETROSPECTIVE STUDIES OF OPERATING PROBLEMS IN AIR TRANSPORT
C. E. Billings, J. K. Lauber, G. E. Cooper, and H. P. Ruffell-Smith *In its* Aircraft Safety and Operating Problems 1976 p 585-590 ref (For primary document see N77-18081 09-03)
Avail: NTIS HC A99/MF A01 CSCL 01C

An epidemiological model for the study of human errors in aviation is presented. In this approach, retrospective data are used as the basis for formulation of hypotheses as to system factors which may have contributed to such errors. Prospective experimental studies of aviation operations are also required in order to prove or disprove the hypotheses, and to evaluate the effectiveness of intervention techniques designed to solve operational problems in the aviation system.
Author

N77-18114*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SIMULATION STUDIES OF AIR TRANSPORT OPERATIONAL PROBLEMS
John K. Lauber, Charles E. Billings, James E. Stevenson, H. P. Ruffell-Smith, and George E. Cooper *In its* Aircraft Safety and Operating Problems 1976 p 591-602 ref (For primary document see N77-18081 09-03)
Avail: NTIS HC A99/MF A01 CSCL 01C

An experimental evaluation of the monitored approach procedure for conducting low visibility instrument approaches is described. Four airline crews each flew 16 approaches using the monitored procedure and 16 using a modified standard procedure in a DC-10 simulator under various conditions of visibility, wind shear and turbulence, and radar vectoring scenarios. In terms of system measures of aircrew performance, no major differences were found. Pilot opinion data indicate that there are some desirable characteristics of the monitored procedure, particularly with reference to the increased role of the flight engineer in conducting low visibility approaches. Rationale for developing approach procedures is discussed.
Author

N77-18115*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PRELIMINARY REPORT ON AIRLINE PILOT SCAN PATTERNS DURING SIMULATED ILS APPROACH
Amos A. Spady, Jr. *In its* Aircraft Safety and Operating Problems 1976 p 603-616 (For primary document see N77-18081 09-03)
Avail: NTIS HC A99/MF A01 CSCL 17G

A series of ILS approaches using seven airline-rated Boeing 737 pilots in an FAA qualified simulator have been conducted. The test matrix included both manual and coupled approaches with and without atmospheric turbulence in Category II weather. A nonintrusive oculometer system was used to track the pilot's eye-point-of-regard throughout the approach. The results indicate that, in general, the pilots use a different scan technique for the manual and coupled conditions; however, the introduction of atmospheric turbulence does not greatly affect the scan behavior in either case. A comparison is made between the objective measures of the instrument scan (oculometer data) and the pilots' opinions of their instrument use. The data show a high degree of consistency among pilots for both the quantitative data and the qualitative data (pilots' opinions). However, there is a slightly lower agreement between the quantitative and qualitative measures.
Author

N77-18116*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A SYSTEMATIC APPROACH TO ADVANCED COCKPIT WARNING SYSTEMS FOR AIR TRANSPORT OPERATIONS: LINE PILOT PREFERENCES
Douglas H. Williams and Carol A. Simpson *In its* Aircraft Safety and Operating Problems 1976 p 617-644 refs (For primary document see N77-18081 09-03)
(Grant NGL-05-046-002)
Avail: NTIS HC A99/MF A01 CSCL 05E

Line pilots (fifty captains, first officers, and flight engineers) from 8 different airlines were administered a structured questionnaire relating to future warning system design and solutions to current warning system problems. This was followed by a semantic differential to obtain a factor analysis of 18 different cockpit warning signals on scales such as informative/distracting, annoying/soothing. Half the pilots received a demonstration of the experimental text and voice synthesizer warning systems before answering the questionnaire and the semantic differential. A control group answered the questionnaire and the semantic differential first, thus providing a check for the stability of pilot preferences with and without actual exposure to experimental systems. Generally, the preference data obtained revealed much consistency and strong agreement among line pilots concerning advance cockpit warning system design.
Author

N77-18117*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HELICOPTER SLING LOAD ACCIDENT/INCIDENT SURVEY: 1968 - 1974
J. D. Shaughnessy and M. D. Pardue (Old Dominion Univ.) Mar. 1977 21 p
(NASA-TM-X-74007) Avail: NTIS HC A02/MF A01 CSCL 01C

During the period considered a mean of eleven accidents per year occurred and a mean of eleven persons were killed or seriously injured per year. Forty-one percent of the accidents occurred during hover, and 63 percent of the accidents had pilot error listed as a cause/factor. Many accidents involved pilots losing control of the helicopter or allowing a collision with obstructions to occur. There was a mean of 58 incidents each year and 51 percent of these occurred during cruise. Author

N77-18118*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PRELIMINARY STUDY OF TUG-GLIDER FREIGHT SYSTEMS UTILIZING A BOEING 747 AS THE TUG
Harry H. Heyson and Willard E. Foss, Jr. Feb. 1977 52 p refs
(NASA-TM-X-74006) Avail: NTIS HC A04/MF A01 CSCL 01C

Performance of the tug-glider system was severely limited by ground run. In most cases studied, additional engines were necessary. Except at short ranges for which additional payload were carried in the tow plane, the productivity of the basic aircraft was degraded by a reduction in cruise speed necessitated by the glider drag. Excessive aspect ratios did not improve system performance because of the increase in glider wing weight. Powered gliders using a tow plane only for takeoff and climb had the potential for a major reduction in fuel consumption. Uncertainty of restrictive regulatory action and the apparently increased airborne investment per unit productivity are obstacles to commercial development. Author

N77-18119# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT: OVERSEAS NATIONAL AIRWAYS, INCORPORATED DOUGLAS DC-10-30, N1032F. JOHN F. KENNEDY INTERNATIONAL AIRPORT, JAMAICA, NEW YORK, 12 NOVEMBER 1975
16 Dec. 1976 52 p refs
(NTSB-AAR-76-19) Avail: NTIS HC A04/MF A01

A Douglas DC-10-30 crashed while attempting to take off at JFK Airport, New York. During the takeoff roll, the aircraft struck sea gulls and the takeoff was rejected. The right engine disintegrated and caught fire; several tires and wheels disintegrated; and the aircraft did not decelerate as expected. Near the end of the runway, the captain steered the aircraft onto a taxiway; the landing gear collapsed, and most of the aircraft was consumed by the fire. Of the 139 persons on the aircraft, 2 were seriously injured and 30 were slightly injured. The probable cause of the accident was the disintegration and subsequent fire in the no. 3 engine when it ingested a large number of sea gulls. Following the disintegration of the engine, the aircraft failed to decelerate effectively because: (1) the no. 3 hydraulic system was inoperative, which caused the loss of the no. 2 brake system and braking torque to be reduced 50 percent; (2) the no. 3 engine thrust reversers were inoperative; (3) at least three tires disintegrated; (4) the no. 3 system spiler planels on each wing could not deploy; and (5) the runway surface was wet. Author

N77-18120# Bundesministerium der Verteidigung, Bonn (West Germany). Ruestungshauptabteilung.
LIGHTNING HAZARDS TO JET AIRCRAFT, PART 1 [BLITZGEFAEHRDUNG VON STRAHLFLUG2 :N, TEIL 1]
R. Muehleisen and H.-J. Fischer DOKZENTBw 1976 49 p refs In GERMAN; ENGLISH summary
(BMVg-FBWT-76-14) Avail: NTIS HC A03/MF A01; DOKZENTBw DM 30

Statistical data concerning the frequency of lightning strikes to aircraft as a function of different parameters, especially the flight level, the ambient temperature, and the electric field strength, are presented. It is shown that an aircraft is not struck only accidentally by lightning, but is able either to influence the lightning path due to its properties as a metallic conductor or to trigger a lightning strike. Based on the experimental investigations and theoretical calculations, values are presented of the magnitude and the direction of the electric field vectors inside and outside of shower- and thunderclouds. Inside the thunderstorm cell the magnitude of the electric field may reach 100,000 V/m or more, whereas the values are between 100 and 1000 V/m at a distance of some kilometers from the thundercloud. It is shown which values of the field strength and the charge at the plane result from the influence of the atmospheric electric fields. Author (ESA)

N77-18121# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
A COMPUTER-ASSISTED METHOD FOR DETERMINING LOGAIR ROUTE STRUCTURES M.S. Thesis
Michael F. McPherson Jun. 1976 82 p refs
(AD-A030288; SLSR-17-76A) Avail: NTIS HC A05/MF A01 CSCL 15/5

This study developed a computer-assisted method for determining LOGAIR route structures. A Mixed-integer model was used to develop the route structures. The objective was to minimize contract cost which was expressed as a function of miles flown and landings. The Honeywell LP6000 package was used to solve the model. The computer-assisted method was tested for FY 75 and FY 76. The computer-assisted method solutions were compared to the routes used by AFLC during FY 75 and FY 76. The results show that the computer-assisted method obtained an estimated savings of approximately $2 million in FY 75 and $1 million in FY 76. The writers conclude that the computer method is a useful tool for developing route structures and recommend the procedure be adopted by AFLC. Author (GRA)

N77-18122# School of Aerospace Medicine, Brooks AFB, Tex.
MIDAIR COLLISIONS: AEROMEDICAL CONSIDERATIONS
James E. Yoder and Royce Moser, Jr. Aug. 1976 29 p refs Revised
(AF Proj. 9993)
(AD-A030001; SAM-Review-4-76; SAM-TR-76-29) Avail: NTIS HC A03/MF A01 CSCL 01/2

Midair collisions have become an increasingly important fraction of total aircraft accidents in recent years. Psychophysiologic factors which have a bearing on collision avoidance are discussed in greater detail in this revision of an earlier review. Author (GRA)

N77-18123# Naval Air Development Center, Warminster, Pa. Crew Systems Dept.
HELICOPTER UNDERWATER ESCAPE LIGHTING Final Report
Gloria Twine Chisum 30 Aug. 1976 15 p refs
(AD-A030409; NADC-76265-40) Avail: NTIS HC A02/MF A01 CSCL 01/3

Egress from an aircraft downed in water will be less difficult if personnel are aided in locating exit points and surface direction. Several factors affecting suitable visual aids for a CH-46 helicopter are considered. Potential light sources and methods of mounting them are discussed. Author (GRA)

N77-18124# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
A MATHEMATICAL MODEL FOR DETERMINING LOGAIR FLIGHT SCHEDULES M.S. Thesis
K. D. Moberly and Theodore C. Gorychka Jun. 1976 100 p refs
(AD-A030295; SLSR-27-76A) Avail: NTIS HC A05/MF A01 CSCL 15/5

Logistics Air Transportation System (LOGAIR) is a contracted priority cargo airlift service operated by the United States Air Force. An important problem facing the LOGAIR system is the amount of pipeline time incurred by cargo moving through the system. This thesis develops a mathematical model which reduces pipeline time. The model is a linear program that produces a schedule of aircraft arrival and departure times for a specified route structure consisting of flights and stations. The objective function is structured to minimize ground time for cargo moving station to station on the same flight, and for cargo transferring between flights. The model solution produced an optimum schedule for six flights connecting eleven stations with sixteen transfers in the LOGAIR system. Analysis indicated a significant reduction in pipeline time when compared to an actual LOGAIR schedule that was manually formulated. Author (GRA)

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N77-18125# IIT Research Inst., Annapolis, Md.
ANALYTICAL DETERMINATION OF TACAN/DME SYSTEM PERFORMANCE IN A DABS ENVIRONMENT Final Report
J. L. Wingard and C. W. Ehler Jun. 1976 51 p refs Prepared for the DOD, Washington, D.C.
(Contracts DOT-FA70WAI-175; F19628-76-C-0017; AF Proj. 649E)
(AD-A031878; ECAC-PR-75-055; FAA-RD-76-85) Avail: NTIS HC A04/MF A01 CSCL 17/7

A program was developed for simulating operation of a single TACAM/DME beacon with various numbers of TACAN/DME aircraft interrogators. Beacon performance was predicted. Interference from a deployment of airborne DABS aircraft was superimposed upon the TACAN/DME beacon to determine the interference effect. TACAN/DME interrogator performance as a function of beacon performance was also predicted. Simulation results are presented in terms of probability of beacon reply, probability of interrogator acquire lock, expected time for interrogator acquire lock, beacon dead time generated by DABS signals, and number of TACAN replies generated by the beacon in response to DABS signals. Author

N77-18126# Aerospace Guidance and Metrology Center, Newark Air Force Station, Ohio. Plans and Programs Office.
DATA EXCHANGE FOR INERTIAL SYSTEMS
Earl T. Bodem 6 Sep. 1976 653 p ref Proc. of 9th Conf. held in St. Petersburg, Fla., 18-19 Nov. 1975
(AD-A031049; AGMC-XRX-76-5) Avail: NTIS HC A99/MF A01 CSCL 17/7

The proceedings of the Ninth Data Exchange for Inertial Systems, hosted by MacDill and Honeywell Aerospace Division, St. Petersburg, FL, 18-19 November 1975, include technical notes and texts of briefings given in the areas of New Technology, Test and Support, Life Cycle Cost, Standardization, Bearings, and Software. Author (GRA)

N77-18127# Facility Checking Squadron (1866th) (AFCS), Richards-Gebaur AFB, Mo.
ILS AND TACAN EVALUATION REPORT, TRAVIS AFB, CALIFORNIA Final Report, 31 Mar. - 11 Apr. 1976
Kathryn Y. Barnhart 23 Aug. 1976 121 p
(AD-A031125; Rept-76/66N-66) Avail: NTIS HC A06/MF A01 CSCL 17/7

This report presents the results of the 31 March-11 April 1976 evaluation of the Travis AFB AN/GRN-19A TACAN, AN/GRN-27 SSILS, and their associated power systems. The evaluation was conducted to observe the facilities in their installed environment and to determine their capabilities and limitations. Results show that both facilities are capable of satisfying the user's requirement; however, recommendations are made to improve facilities. The results obtained can be used as a guide to anticipated performance until there is a significant change in either ground equipment, siting, or screening. Author (GRA)

N77-18128# Instrument Flight Center, Randolph AFB, Tex.
EVALUATION OF REVISED APPROACH LIGHTING CRITERIA
Kenneth J. Kerkering 9 Aug. 1976 9 p refs
(AD-A030073; IFC-LR-76-1) Avail: NTIS HC A02/MF A01 CSCL 01/5

The Federal Aviation Administration (FAA) has directed conversion of all ALSF-1, Category I ILS approach lighting systems with sequenced flashing lights to the Simplified Short Approach Lighting System with Runway Alignment Indicator Lights (SSALR) and Medium Intensity Approach Lighting System with Runway Alignment Lights (MALSR). Although the FAA directive affects civilian aerodromes only, the Air Force is concerned that the lighting change may have an adverse affect on the operational capability of the Air National Guard, Air Force Reserve, and Air Defense Command units which operate from these airfields. Therefore, Headquarters Air Force has requested the USAF Instrument Flight Center (USAFIFC) conduct an in-flight pilot factors (PIFAX) evaluation of the SSALR and MALSR approach lighting system. This evaluation will provide the data necessary for the Air Force to formulate a position on the operational acceptability of the SSALR and MALSR systems. This interim report summarized the IFC/RD findings of the pre-validation portion of the evaluation. GRA

N77-18129# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
AN INVESTIGATION OF PSEUDO ILS Final Technical Report, 1 Jan. 1975 - 31 May 1976
W. E. Sears, L. D. Holland, J. V. Vogt, and E. R. Flynt 30 Jun. 1976 156 p refs
(Contract N00014-75-C-1008; RF41423801)
(AD-A030379; ONR-CR-213-108-4F) Avail: NTIS HC A08/MF A01 CSCL 01/2

The overall objective of the MARCOR Radar Landing Systems program at Georgia Tech over the past four years has been to analyze the performance of aircraft landing systems of interest to the Navy. The work described herein was directed specifically toward investigating theoretically and experimentally the utility of the Pseudo ILS concept. The investigation consisted of a design and implementation of the Pseudo ILS concept using an AN/TPN-8 precision approach radar supplied by the Marine Corps and a Republic Industries special data link. The report includes the following items: (1) a description of the pseudo ILS concept, (2) a presentation of the simulation analysis used to determine appropriate design parameters, (3) a detailed description of the design and construction of the Tracking Unit and Interface Unit, and (4) a presentation of the flight test results. Feasibility of the concept was demonstrated with flight test results showing sufficiently small closed loop errors for Mode II landings. Sensitivity of the results to various test parameters was not obtained due to limited time and funds. Several areas are recommended for further study. Author (GRA)

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N77-18130*# Boeing Vertol Co., Philadelphia, Pa.
RESEARCH REQUIREMENTS TO REDUCE EMPTY WEIGHT OF HELICOPTERS BY USE OF ADVANCED MATERIALS
Donald J. Hoffstedt Dec. 1976 30 p refs
(Contract NAS1-13624)
(NASA-CR-145113) Avail: NTIS HC A03/MF A01 CSCL 01C

Utilization of the new, lightweight, high-strength, aerospace structural-composite (filament/matrix) materials, when specifically designed into a new aircraft, promises reductions in structural empty weight of 12 percent at recurring costs competive with metals. A program of basic and applied research and demonstration is identified with the objective of advancing the state of the art to the point where civil helicopters are confidently designed, produced, certified, and marketed by 1985. A structural empty-weight reduction of 12 percent was shown to significantly reduce energy consumption in modern high-performance helicopters. Author

N77-18131*# Boeing Commercial Airplane Co., Seattle, Wash.
DEVELOPMENT OF THE TECHNOLOGY FOR THE FABRICATION OF RELIABLE LAMINAR FLOW CONTROL PANELS Final Report
D. D. Weiss and D. V. Lindh Feb. 1977 120 p refs
(Contract NAS1-14407)
(NASA-CR-145124; D6-44184) Avail: NTIS HC A06/MF A01 CSCL 01C

Various configurations of porous, perforated and slotted materials were flow tested to determine if they would meet the LFC surface smoothness and flow requirements. The candidate materials were then tested for susceptibility to clogging and for resistance to corrosion. Of the materials tested, perforated titanium, porous polyimide, and slotted assemblies demonstrated a much greater resistance to clogging than other porous materials. Author

N77-18132*# Rockwell International Corp., Columbus, Ohio. Aircraft Div.
LIFT CRUISE FAN V/STOL AIRCRAFT CONCEPTUAL DESIGN STUDY T-39 MODIFICATION. VOLUME 1: TECHNICAL REPORT
Donald W. Elliott Nov. 1976 169 p refs
(Contract NAS2-9307)
(NASA-CR-151925) Avail: NTIS HC A08/MF A01 CSCL 01C

The conversion of two T-39 aircraft into lift cruise fan research and technology vehicles is discussed. The concept is based upon modifying the T-39A (NA265-40) Sabreliner airframe into a V/STOL configuration by incorporating two LCF-459 lift cruise fans and three YJ-97 gas generators. The propulsion concept provides the thrust for horizontal flight or lift for vertical flight by deflection of bifurcated nozzles while maintaining engine out safety throughout the flight envelope. The configuration meets all the study requirements specified for the design with control powers in VTOL and conversion in excess of the requirement making it an excellent vehicle for research and development. The study report consists of two volumes; Volume 1 (Reference a) contains background data detailed description and technical substantiation of the aircraft. Volume 2 includes cost data, scheduling and program planning not addressed in Volume 1. Author

N77-18133*# Rockwell International Corp., Columbus, Ohio. Aircraft Div.
LIFT CRUISE FAN V/STOL AIRCRAFT CONCEPTUAL DESIGN STUDY T-39 MODIFICATION. VOLUME 2: SCHEDULES AND BUDGETARY DATA
Nov. 1976 33 p refs
(Contract NAS2-9307)
(NASA-CR-151926) Avail: NTIS HC A03/MF A01 CSCL 01C

For abstract, see N77-18132.

N77-18134*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AUTOMATICALLY LOCKABLE AXIALLY EXTENSIBLE STRUT Patent Application
Frank Bonisch, inventor (to NASA) (Silcorsky Aircraft) Filed 7 Mar. 1977 13 p Sponsored by NASA
(NASA-Case-LAR-11900-1; US-Patent-Appl-SN-775239) Avail: NTIS HC A02/MF A01 CSCL 01C

This invention relates to a low friction, axially extensible secondary struct link between a helicopter main rotor force measurement system and the helicopter frame which is automatically lockable and capable of transmitting both tension and compression loads to the helicopter frame in the event of primary link failure. NASA

N77-18135*# General Dynamics/Convair, San Diego, Calif.
VEHICLE DESIGN EVALUATION PROGRAM (VDEP): A COMPUTER PROGRAM FOR WEIGHT SIZING, ECONOMIC, PERFORMANCE AND MISSION ANALYSIS OF FUEL-CONSERVATIVE AIRCRAFT, MULTIBODIED AIRCRAFT AND LARGE CARGO AIRCRAFT USING BOTH JP AND ALTERNATIVE FUELS
B. H. Oman Jan. 1977 425 p refs
(Contract NAS1-13285)
(NASA-CR-145070) Avail: NTIS HC A18/MF A01 CSCL 01C

The capability of the existing NASA Langley Research Center vehicle design evaluation program was studied. The three major areas of expansion were: (1) incorporation into the program of a capability to conduct preliminary design studies on subsonic commercial transport type aircraft using both JP and such alternate fuels as hydrogen and methane; (2) incorporation of an aircraft detailed mission and performance analysis capability; and (3) development and incorporation of an external loads analysis capability. Author

N77-18136*# Bell Helicopter Co., Fort Worth, Tex.
CORRELATION OF AH-1G HELICOPTER FLIGHT VIBRATION DATA AND TAILBOOM STATIC TEST DATA WITH NASTRAN ANALYTICAL RESULTS
James D. Cronkhite, Henry E. Wilson, and Victor L. Berry [1976] 148 p refs
(Contract NAS1-13801)
(NASA-CR-145120) Avail: NTIS HC A07/MF A01 CSCL 01C

Level flight airframe vibration at main rotor excitation frequencies was calculated. A NASTRAN tailboom analysis was compared with test data for evaluation of methods used to determine effective skin in a semimonocoque sheet-stringer structure. The flight vibration correlation involved comparison of level flight vibration for two helicopter configurations: clean wing, at light gross weight and wing stores at heavy gross weight. In the tailboom correlation, deflections and internal loads were compared using static test data and a NASTRAN analysis. An iterative procedure was used to determine the amount of effective skin of buckled panels under compression load. Author

N77-18137*# Sperry Flight Systems, Phoenix, Ariz.
SIMULATOR EVALUATION OF OPTIMAL THRUST MANAGEMENT/FUEL CONSERVATION STRATEGIES FOR AIRBUS AIRCRAFT ON SHORT HAUL ROUTES Final Report, Mar. - Nov. 1976
John H. Bochem, David C. Mossman, and Philip D. Lanier Jan. 1977 164 p refs
(Contract NAS2-9174)
(NASA-CR-151966) Avail: NTIS HC A08/MF A01 CSCL 01C

The feasibility of incorporating optimal concepts into a practical system was determined. Various earlier theoretical analyses were confirmed, and insight was gained into the sensitivity of fuel conservation strategies to nonlinear and second order aerodynamic and engine characteristics. In addition to the investigation of optimal trajectories the study ascertained combined fuel savings by utilizing various procedure-oriented improvements such as delayed flap/decelerating approaches and great circle navigation. Author

N77-18138*# Boeing Co., Seattle, Wash.
LOW SPEED TESTS OF A FIXED GEOMETRY INLET FOR A TILT NACELLE V/STOL AIRPLANE
J. Syberg and J. L. Koncsek Jan. 1977 81 p refs
(Contract NAS2-9215)
(NASA-CR-151922; D180-20276-1) Avail: NTIS HC A05/MF A01 CSCL 01C

Test data were obtained with a 1/4 scale cold flow model of the inlet at freestream velocities from 0 to 77 m/s (150 knots) and angles of attack from 45 deg to 120 deg. A large scale model was tested with a high bypass ratio turbofan in the NASA/ARC wind tunnel. A fixed geometry inlet is a viable concept for a tilt nacelle V/STOL application. Comparison of data obtained with the two models indicates that flow separation at high angles of attack and low airflow rates is strongly sensitive to Reynolds number and that the large scale model has a significantly improved range of separation-free operation. Author

N77-18139# Dornier-System G.m.b.H., Friedrichshafen (West Germany).
TEST DATA ORGANIZATION AND PREPARATION FOR THE FLIGHT TESTS OF THE ALPHA JET PROTOTYPES [MESSDATENORGANISATION UND MESSDATENAUFBEREITUNG BEI DEN FLUGVERSUCHEN DER ALPHA-JET-PROTOTYPEN]
H. Friedrich, E. Juenke, P. Kuehl, and L. Platzroeder May 1976 38 p In GERMAN
(DS-BS-86/76) Avail: NTIS HC A03/MF A01

The methods used for preprocessing the data resulting from flight tests of Alpha Jet prototypes are described. Data received from test aircraft were stored on magnetic tape. Preprocessing encompasses digitalization, data compression, conversion of data

formats, synchronization of test values, asynchronous data processing, smoothing, and filtering. ESA

N77-18140# Kaman Avidyne, Burlington, Mass.
NOVA-2: A DIGITAL COMPUTER PROGRAM FOR ANALYZING NUCLEAR OVERPRESSURE EFFECTS ON AIRCRAFT. PART 1: THEORY Final Report
William N. Lee and Lawrence J. Mente Kirtland AFB, N. Mex. AFWL Aug. 1976 212 p
(Contract F29601-75-C-0032; AF Proj. 8809)
(AD-A029388; KA-TR-128-Pt-1; AFWL-TR-75-262-Pt-1) Avail: NTIS HC A10/MF A01 CSCL 01/3

NOVA-2 (Nuclear Overpressure Vulnerability Analysis, Version 2) is an updated version of NOVA, a FORTRAN-4 digital computer program for calculating the response of individual structural elements of aircraft, such as stringers, frames and panels, exposed to the transient pressure loading associated with the blast wave from a nuclear explosion. The updated version extends the capability of NOVA to analyze rib elements, frames with variable cross section, and offers a choice of clamped, simply supported or free edge boundary conditions. For inelastic structural response, a much improved elastic-plastic model for material behavior is provided. Also added to NOVA is the REFRA near-ground reflections model for blast waves. The program still provides the overall capability to analyze multilayered beam and panel elements exposed to a steady-state subsonic or supersonic aerodynamic preload, followed by a dynamic blast wave. A critical slant range is automatically determined in an iteration where damage criteria (specified on a probabilistic basis) are compared with the structural response. GRA

N77-18141# Kaman Avidyne, Burlington, Mass.
NOVA-2: A DIGITAL COMPUTER PROGRAM FOR ANALYZING NUCLEAR OVERPRESSURE EFFECTS ON AIRCRAFT. PART 2: COMPUTER PROGRAM Final Report
William N. Lee and Lawrence J. Mente Kirtland AFB, N. Mex. AFWL Aug. 1976 155 p refs
(Contract F29601-75-C-0032; AF Proj. 8809)
(AD-A029389; KA-TR-128-Pt-2; AFWL-TR-75-262-Pt-2) Avail: NTIS HC A08/MF A01 CSCL 01/3

NOVA-2 (Nuclear Overpressure Vulnerability Analysis, Version 2) is an updated version of NOVA, a FORTRAN-4 digital computer program for calculating the response of individual structural elements of aircraft, such as stringers, frames and panels, exposed to the transient pressure loading associated with the blast wave from a nuclear explosion. The updated version extends the capability of NOVA to analyze rib elements, frames with variable cross section, and offers a choice of clamped, simply supported or free edge boundary conditions. GRA

N77-18142# Sikorsky Aircraft, Stratford, Conn.
HELICOPTER DRIVE SYSTEM ON-CONDITION MAINTENANCE CAPABILITY
Jul. 1976 213 p refs
(Contract DAAJ02-74-C-0045; DA Proj. 1F2-62203-AH-86)
(AD-A028414; USAAMRDL-TR-75-57) Avail: NTIS HC A10/MF A01 CSCL 01/3

This report presents the results of a study that was conducted to determine the feasibility of operating CH-53/54 gearboxes without any scheduled removals for overhaul, that is, being maintained on-condition. A reliability analysis technique was developed to establish gearbox hazard functions, which express the relationship between the equipment failure rate and its operating time. Furthermore, design concepts and procedures were identified which enhance on-condition maintenance for CH-53/54 gearboxes. Concurrent with the initiation of an on-condition maintenance policy, it is recommended that field and depot maintenance of on-condition gearboxes be monitored. The fact that data for this study was obtained from aircraft that flew in Vietnam where they saw overtorque situations reinforces the practicality of an on-condition maintenance philosophy for the transmission system. The reliability analysis technique developed by this study used hazard functions of individual generic component failure modes as building blocks to construct the gearbox level hazard function for each category of failure mode. The method permits evaluation of current design practices. Its real benefit is that it will allow future gearbox reliability requirements to be evaluated by the designer so that reliability is understood and designed in. GRA

N77-18143# Bell Helicopter Co., Fort Worth, Tex.
DEVELOPMENT OF DESIGN AND MANUFACTURING TECHNOLOGY FOR BALLISTIC-DAMAGE-TOLERANT FLIGHT CONTROL COMPONENTS Final Report, May 1973 - Jun. 1975
Sam C. Aker Jul. 1976 54 p
(Contract DAAJ02-73-C-0063)
(AD-A028416; BHC-699-199-001; USAAMRDL-TR-76-6) Avail: NTIS HC A04/MF A01 CSCL 01/3

Composite ballistic-damage-tolerant aircraft control components, as a concept, had been proven prior to this program. Parts had been fabricated, but only on a prototype basis. It was the objective of this program to develop and demonstrate a manufacturing technology which would enable such parts to be made on a production basis. Two components in the AH-1G antitorque control system were chosen for samples. These parts were redesigned to be ballistic-damage-tolerant and were then fabricated with specially designed tooling. The completed parts were mechanically, ballistically, and environmentally tested to prove soundness of design and fabrication. The program showed that manufacturing could be done on a production basis, resulting in parts that are very satisfactory in quality and performance. Author (GRA)

N77-18144# IBM Federal Systems Div., Owego, N.Y.
PROGRAM DOCUMENTATION FOR THE DIGITAL SWITCHING EXPERIMENT PROGRAM
D. L. Wartluft Wright-Patterson AFB, Ohio AMRL Apr. 1976 42 p
(Contract F33615-75-C-5152; AF Proj. 7184)
(AD-A030363; AMRL-HESS-76-5; AMRL-TR-76-42) Avail: NTIS HC A03/MF A01 CSCL 09/2

The Digital Switching Experiment Program is an interactive control system used for evaluating three different switching concepts in a simulated aircraft environment. The basic goal of the experiment is to assess pilot switching performance on a simple communications task while engaged in a tracking task that approximates formation flying. The three switching concepts to be evaluated include: (1) a conventional UHF control head (ARC-34) to provide baseline data on present-day manual systems, (2) a pushbutton keyboard (F-15 navigation panel switches) that reflects the proposed DAIS concept for fighter aircraft and, (3) a voice command system that employs an automatic speech recognition system to augment the control of cockpit functions. The program was written for an IBM S/370, Model 155 Computer using the MFT version of the standard Operating System. The simulated cockpit is interfaced through an IBM 1827 Data Control Unit and the graphics displays are presented on two IBM 2250 Display Units. Both assembler language and FORTRAN IV were used in the software development. Author (GRA)

N77-18145# Northrop Research and Technology Center, Hawthorne, Calif.
PROGRAM FOR EXPERIMENTAL INVESTIGATION OF FAILURE PROGNOSIS OF HELICOPTER GEARBOXES Final Report
James J. Reis Aug. 1976 329 p refs
(Contract DAAJ02-72-C-0118; DA Proj. 1F1-62203-A-434)
(AD-A030071; NRTC-74-52R; USAAMRDL-TR-76-13) Avail: NTIS HC A15/MF A01 CSCL 13/9

This report presents the results of an experimental program to collect, document, and process sensor data from UH-1 helicopter 90 deg gearboxes under carefully controlled conditions. The object of the program was to establish experimentally which types of sensors and what kind of data processing give useful prognostic information. GRA

N77-18146# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
EVALUATION OF POTENTIAL ENVIRONMENTAL CONTROL SYSTEMS FOR MACH 3 TROOP TRANSPORT AIRCRAFT Final Report, Jul. 1972 - Jul. 1973
Roland J. Watts Jan. 1976 148 p refs
(AF Proj. 6146)
(AD-A030344; AFFDL-TR-75-31) Avail: NTIS

HC A07/MF A01 CSCL 13/1

The purpose of this report was to select potential environmental control systems (ECS) to be used in the 256 seat supersonic troop transport cruising at Mach 3. Those systems under consideration were (1) bootstrap air cycle environmental control system with an air cooled compartment wall, (2) semiclosed bootstrap air cycle environmental control system with an air cooled compartment wall, (3) semiclosed vapor cycle environmental control system with an air cooled compartment wall, (4) semiclosed vapor cycle environmental control system with a liquid cooled compartment wall, and (5) semiclosed vapor cycle environmental control system with a liquid cooled compartment wall and without a water boiler. The last four of the five systems recirculated approximately 50% of the compartment air (250 lb/min) and the rest of the compartment air was exhausted through an ECS heat exchanger. Two types of compartment walls were examined: an air cooled wall and a liquid cooled wall. Fuel was used as the primary heat sink in all the systems. The maximum internal heat load under which each system was analyzed was the same, 158,000 Btu/hr. The total combined maximum internal and external heat load for the first four systems was 417,000 Btu/hr and the fifth system, 577,000 Btu/hr. Except for the liquid cooled wall, the systems selected for consideration represent a number of different types of basic systems that have appeared previously for supersonic aircraft. The main criteria used for selecting an environmental control system was based on the weight penalty considerations. GRA

N77-18147# Grumman Aerospace Corp., Bethpage, N.Y.
HYCOS (HYDRAULIC CHECKOUT SYSTEM), PHASE 1 Final Report, 5 Jan. - 31 Jul. 1976
John J. Duzich 30 Jul. 1976 103 p refs
(Contract N62269-76-C-0195)
(AD-A029788; NADC-75168-30) Avail: NTIS HC A06/MF A01 CSCL 13/7

This six month study effort investigated the normal and abnormal operating parameters of critical flight components found in a typical sophisticated airborne hydraulic system. The basis for this investigation was to establish the ground rules necessary to develop monitoring criteria for components used within the system. Normal operating parameters were defined and proposed limits established with respect to components, subsystem and systems. Components considered suitable for monitoring included reservoirs, pumps, accumulators, pneumatic bottles, shock struts, flight control actuators, desiccants, relief valves and other components. Fluid processing to determine particulate matter, water and chlorine could not be readily detected within the system however consideration was given to provide sampling ports at strategic locations within the system without the addition of sampling valves. GRA

N77-18148# Boeing Vertol Co., Philadelphia, Pa.
HEAVY LIFT HELICOPTER - CARGO HANDLING ATC PROGRAM. VOLUME 1: DETAIL DESIGN STRUCTURAL AND WEIGHTS ANALYSIS AND STATIC AND DYNAMIC LOAD ANALYSIS Final Report, Jun. 1971 - Jun. 1974
R. Campbell, W. Nutley, J. Shefrin, L. Simpson, and B. Solak Jan. 1976 473 p refs
(Contract DAAJ01-71-C-0840)
(AD-A030072; USAAMRDL-TR-74-97A-Vol-1) Avail: NTIS HC A20/MF A01 CSCL 01/3

This report presents formal documentation of efforts and results of the cargo handling system segment of the Heavy Lift Helicopter (HLH) Advanced Technology Component (ATC) development program. The purpose of the HLH/ATC program was to minimize technical cost, and schedule risks associated with future HLH system research, development, test and evaluation (RDTE) and production programs. This was achieved by design, fabrication, and testing of specific ATC hardware in three critical air vehicle subsystems: (1) Rotor/drive system; (2) Flight control system; (3) Cargo handling system. The HLH cargo handling system described herein consists of: tandem pneumatically driven hoists which provide high-speed in-flight stability with pitch attitude optimization and long-reach cargo acquistion and delivery for externally slung cargo; a visual augmentation system to assist the load controlling crewman in acquiring cargo from a hover under conditions of darkness and partial visual obscuration; and a static electricity discharge system to protect ground handlers from shock hazards. GRA

N77-18149# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
ICING TESTING IN THE LARGE MODANE WIND TUNNEL ON A REDUCED-SCALE MODEL OF A HELICOPTER ROTOR
C. Armand and F. Charpin May 1976 24 p refs Transl. into ENGLISH from l'Aeronautique et l'Astronautique (France), no. 55, 1975-1976 p 19-28
(AD-A030110; CRREL-TL-523) Avail: NTIS HC A02/MF A01 CSCL 01/3

Icing tests on full-scale models of parts of aircraft, equipped with actual de-icing systems, have been carried out in the large Modane wind tunnel of ONERA since 1962. During the last few years, ONERA has perfected and proved the technique for similitude icing testing on reduced-scale models; during the winter of 1973-74, in cooperation with the Societe Nationale Industrielle Aerospatiale (SNIAS), ONERA has extended the operating range of this wind tunnel to include helicopter rotors. Although detailed comparisons with flight tests are not now available, it appears that the variations in such parameters as lift, thrust, and moment are similar to those given by flight data. Some limitations are due to the minimum available temperature and the annual cold time; nevertheless, the total range of speeds during flight (except hovering) may be investigated without risk with this technique, with observation during the icing period of the behavior of all the parameters defining the simulated flight operation of the helicopter. Author (GRA)

N77-18150# Hughes Helicopters, Culver City, Calif.
ANALYTICAL INVESTIGATION OF AN IMPROVED HELICOPTER LANDING GEAR CONCEPT Final Report, 30 Jun. 1975 - 19 Feb. 1976
A. H. Logan Aug. 1976 89 p refs
(Contract DAAJ02-75-C-0045; DA Proj. 1F2-62209-AH-76)
(AD-A029372; HH-76-37; USAAMRDL-TR-76-19) Avail: NTIS HC A05/MF A01 CSCL 01/3

A design study has been conducted to define a landing gear concept that redistributes the impact energy of an autorotational landing in a manner that minimizes the occurrence of blade/tailboom strikes. The landing gear concept redistributes the impact energy by providing an interconnection between the front and rear landing gears. Through the interconnection, as the rear landing gear moves from the flight static position toward the full in position under landing impact, the front gear is impelled to move from the flight static position toward the full out position. When these motions have been accomplished, the skids (or front and rear wheels) are on the ground surface and the reactions inherent in absorbing the autorotational landing do not produce a pitching moment. A physical design was developed for the OH-6A and compared to the landing gear provisions of MIL-STD-1290. Ground resonance, weight, and life cycle cost analyses were also performed. The analysis indicates that pitch interconnection significantly reduces the nose-down pitching moment that occurs during nose-high autorotation. This increases blade/tailboom spacing, which eliminates the majority of blade/tailboom strikes. Roll interconnection increases the ground resonance boundaries threefold. Author (GRA)

N77-18151# Army Command and General Staff Coll., Fort Leavenworth, Kansas.
THE AEROCRANE IN LOTS OPERATIONS M.S. Thesis. Final Report
John Robert Hauser, Jr. 11 Jun. 1976 78 p refs
(AD-A029793) Avail: NTIS HC A05/MF A01 CSCL 13/10

The Army has relied on Logistics Over the Shore (LOTS) operations to resupply forces already ashore in the absence of adequate fixed port facilities. Large scale use of containers has become standard operating procedure in the Army. Proposals have been made to meet these new requirements. One such proposal resulted in the testing of all currently available lighterage vehicles and the adoption of the Lighterage Air Cushion Vehicle (LACV-30) to support containerized LOTS operations. Another more recent proposal has been the use of the Aerocrane as a potential lighterage vehicle. The thesis investigated this relatively new development to determine the

feasibility of using Aerocranes in LOTS operations and their advantage in comparison with current Army lighterage. The conclusion is that the Aerocrane is both more responsive and more cost effective and should be adopted to support containerized LOTS operations. GRA

N77-17998*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A LINEARIZED THEORY METHOD OF CONSTRAINED OPTIMIZATION FOR SUPERSONIC CRUISE WING DESIGN
David S. Miller, Harry W. Carlson, and Wilbur D. Middleton (Boeing Commercial Airplane Co., Seattle) *In its* Proc. of the SCAR Conf., Part 1 1976 p 9-24 refs (For primary document see N77-17996 09-01)
Avail: NTIS HC A21/MF A01 CSCL 01C

N77-18001*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE ROLE OF FINITE-DIFFERENCE METHODS IN DESIGN AND ANALYSIS FOR SUPERSONIC CRUISE
James C. Townsend *In its* Proc. of the SCAR Conf., Part 1 1976 p 69-84 refs (For primary document see N77-17996 09-01)
Avail: NTIS HC A21/MF A01 CSCL 01C

N77-18020*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AEROACOUSTIC STUDIES OF COANNULAR NOZZLES SUITABLE FOR SUPERSONIC CRUISE AIRCRAFT APPLICATIONS
Orlando A. Gutierrez *In its* Proc. of the SCAR Conf., Pt. 2, 1976 20 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01C

N77-18021*# Pratt and Whitney Aircraft Group, West Palm Beach, Fla.
COANNULAR NOZZLE NOISE CHARACTERISTICS AND APPLICATION TO ADVANCED SUPERSONIC TRANSPORT ENGINES
Hilary Kozlowski *In* NASA. Langley Res. Center Proc. of the SCAR Conf., Pt. 2, 1976 14 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01C

N77-18026*# Boeing Commercial Airplane Co., Seattle, Wash.
TITANIUM AND ADVANCED COMPOSITE STRUCTURES FOR A SUPERSONIC CRUISE ARROW WING CONFIGURATION
M. J. Turner and J. M. Hoy *In* NASA. Langley Res. Center Proc. of the SCAR Conf., Pt. 2, 1976 24 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01C

N77-18027*# Lockheed-California Co., Burbank.
ADVANCED STRUCTURES TECHNOLOGY APPLIED TO A SUPERSONIC CRUISE ARROW-WING CONFIGURATION
I. F. Sakata and G. W. Davis *In* NASA. Langley Res. Center Proc. of the SCAR Conf., Pt. 2, 1976 34 p (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01C

N77-18028*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPUTER-AIDED METHODS FOR ANALYSIS AND SYNTHESIS OF SUPERSONIC CRUISE AIRCRAFT STRUCTURES
Gary L. Giles *In its* Proc. of the SCAR Conf., Pt. 2, 1976 21 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01C

N77-18029*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STRUCTURAL DESIGN STUDIES OF A SUPERSONIC CRUISE ARROW WING CONFIGURATION
Jaroslaw Sobieszczanski, L. Arnold McCullers (Vought Corp., Hampton, Va.), Rodny H. Ricketts (Vought Corp., Hampton, Va.), Nick J. Santoro (Vought Corp., Hampton, Va.), Sharon D. Beskenis (Vought, Corp., Hampton, Va.), and William L. Kurtze (Vought Corp., Hampton, Va.) *In its* Proc. of the SCAR Conf., Pt. 2, 1976 25 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01C

N77-18037*# Boeing Commercial Airplane Co., Seattle, Wash.
TOWARD A SECOND GENERATION FUEL EFFICIENT SUPERSONIC CRUISE AIRCRAFT
Frank D. Neumann *In* NASA. Langley Res. Center Proc. of the SCAR Conf., Pt. 2, 1976 18 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01C

N77-18038*# Boeing Commercial Airplane Co., Seattle, Wash.
TOWARD A SECOND GENERATION FUEL EFFICIENT SUPERSONIC CRUISE AIRCRAFT STRUCTURAL DESIGN FOR EFFICIENCY
James R. Hoy *In* NASA. Langley Res. Center Proc. of the SCAR Conf., Pt. 2, 1976 13 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01C

N77-18039*# Boeing Commercial Airplane Co., Seattle, Wash.
TOWARD A SECOND GENERATION FUEL EFFICIENT SUPERSONIC CRUISE AIRCRAFT PERFORMANCE CHARACTERISTICS AND BENEFITS
John D. Vachal *In* NASA. Langley Res. Center Proc. of the SCAR Conf., Pt. 2, 1976 14 p ref (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01C

N77-18040*# McDonnell-Douglas Corp., St. Louis, Mo.
DESIGN FEASIBILITY OF AN ADVANCED TECHNOLOGY SUPERSONIC CRUISE AIRCRAFT
William T. Rowe *In* NASA. Langley Res. Center Proc. of the SCAR Conf., Pt. 2, 1976 15 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01C

N77-18041*# McDonnell-Douglas Corp., St. Louis, Mo.
STRUCTURAL DESIGN OF SUPERSONIC CRUISE AIRCRAFT
J. E. Fischler *In* NASA. Langley Res. Center Proc. of the SCAR Conf., Pt. 2, 1976 15 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01C

N77-18042*# McDonnell-Douglas Corp., St. Louis, Mo.
PERFORMANCE AND BENEFITS OF AN ADVANCED TECHNOLOGY SUPERSONIC CRUISE AIRCRAFT
Richard D. Fitzsimmons *In* NASA. Langley Res. Center Proc. of the SCAR Conf., Pt. 2, 1976 12 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01C

N77-18043*# Lockheed-California Co., Burbank.
AN ADVANCED CONCEPT THAT PROMISES ECOLOGICAL AND ECONOMIC VIABILITY
Bruce R. Wright, Thomas A. Sedgwick, and David M. Urie *In* NASA. Langley Res. Center Proc. of the SCAR Conf., Pt. 2, 1976 46 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01C

N77-18298# United Technologies Research Center, East Hartford, Conn. Aeroacoustics and Experimental Gas Dynamics Group.
HELICOPTER LASER VELOCIMETER (LV) MEASUREMENTS
J. C. Bennett, Jr. *In* Inst. Franco-Allemand de Rech. de Saint-Louis Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 567-585 refs (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N77-18152# Advisory Group for Aerospace Research and Development, Paris (France).
AGARD FLIGHT TEST INSTRUMENTATION SERIES. VOLUME 8: LINEAR AND ANGULAR POSITION MEASUREMENT OF AIRCRAFT COMPONENTS
J. C. VanderLinden (Natl. Aerospace Lab., Amsterdam) and H. A. Mensink (Natl. Aerospace Lab., Amsterdam) Feb. 1977 47 p refs
(AGARD-AG-160-Vol-8; AGARDograph-160-Vol-8; ISBN-92-835-1236-8) Avail: NTIS HC A03/MF A01

Flight test instrumentation for determining the position of movable aircraft components was considered. The components included: rudder, elevator and aileron surfaces, wing flaps, trim tabs, speed brakes, spoilers, power-control levers, elements of hydraulic systems and airconditioning systems, and elements of nosewheel-steering systems and of landing gear mechanisms.
Author

N77-18153# Instrument Flight Center, Randolph AFB, Tex.
ROLE OF HEAD-UP DISPLAY IN INSTRUMENT FLIGHT Final Report
James F. Barnette 18 Aug. 1976 16 p refs
(AD-A030075; IFC-LR-76-2) Avail: NTIS HC A02/MF A01 CSCL 01/4

The Tactical Air Command (TAC) and Aerospace Defense Command (ADC) have requested USAF Instrument Flight Center (USAFIFC) include Head-Up Display (HUD) information in Air Force Manual 51-37. The TAC and ADC requests are of extreme importance since HUD systems are presently installed in the A-7D, A-10, F-15, and F-111D aircraft and there is an expanding emphasis toward installing HUD systems in future aircraft. The role of HUD in an instrument environment must be defined to ensure its optimum operational utilization during various instrument flight regimes. A pilot factors survey was conducted to determine: (1) The present use of HUDs during instrument flight by USAF pilots; and (2) Problems encountered by USAF pilots while using HUDs during instrument flight. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N77-18154* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE ENGINE AIR INTAKE SYSTEM Patent
Norman E. Sorensen and Eldon A. Latham, inventors (to NASA) Issued 15 Feb. 1977 9 p Filed 12 Sep. 1975 Supersedes N75-31108 (13 - 22, p 2747)
(NASA-Case-ARC-10761-1; US-Patent-4,007,891; US-Patent-Appl-SN-612899; US-Patent-Class-244-53B; US-Patent-Class-137-15.1) Avail: US Patent Office CSCL 21E

An axisymmetric air intake system for a jet aircraft engine comprising a fixed cowl extending outwardly from the face of the engine, a centerbody coaxially disposed within the cowl, and an actuator for axially displacing the centerbody within the cowl was developed. The cowl and centerbody define a main airflow passageway therebetween, the configuration of which is changed by displacement of the centerbody. The centerbody includes a forwardly-located closeable air inlet which communicates with a centerbody auxiliary airflow passageway to provide auxiliary airflow to the engine. In one embodiment, a system for opening and closing the centerbody air inlet is provided by a dual-member centerbody, the forward member of which may be displaced axially with respect to the aft member.
Official Gazette of the U.S. Patent Office

N77-18155*# Boeing Vertol Co., Philadelphia, Pa.
RESEARCH REQUIREMENTS FOR DEVELOPMENT OF REGENERATIVE ENGINES FOR HELICOPTERS
Richard D. Semple Dec. 1976 36 p refs
(Contract NAS1-13624)
(NASA-CR-145112) Avail: NTIS HC A03/MF A01 CSCL 21E

The improved specific fuel consumption of the regenerative engine was compared to a simple-cycle turboshaft engine. The performance improvement and fuel saving are obtained at the expense of increased engine weight, development and production costs, and maintenance costs. Costs and schedules are estimated for the elements of the research and development program. Interaction of the regenerative engine with other technology goals for an advanced civil helicopter is examined, including its impact on engine noise, hover and cruise performance, helicopter empty weight, drive-system efficiency and weight, one-engine-inoperative hover capability, and maintenance and reliability.
Author

N77-18156*# Rockwell International Corp., Los Angeles, Calif.
METHODS FOR COMPARATIVE EVALUATION OF PROPULSION SYSTEM DESIGNS FOR SUPERSONIC AIRCRAFT
R. M. Tyson, R. Y. Mairs, F. D. Halferty, Jr., B. E. Moore, D. Chaloff, and A. W. Knudsen Jun. 1976 181 p refs
(Contract NAS3-19858)
(NASA-CR-135110; NA-76-470) Avail: NTIS HC A09/MF A01 CSCL 21E

The propulsion system comparative evaluation study was conducted to define a rapid, approximate method for evaluating the effects of propulsion system changes for an advanced supersonic cruise airplane, and to verify the approximate method by comparing its mission performance results with those from a more detailed analysis. A table look up computer program was developed to determine nacelle drag increments for a range of parametric nacelle shapes and sizes. Aircraft sensitivities to propulsion parameters were defined. Nacelle shapes, installed weights, and installed performance was determined for four study engines selected from the NASA supersonic cruise aircraft research (SCAR) engine studies program. Both rapid evaluation method (using sensitivities) and traditional preliminary design methods were then used to assess the four engines. The method was found to compare well with the more detailed analyses. Author

N77-18157*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COLD-AIR INVESTIGATION OF A 31/2-STAGE FAN-DRIVE TURBINE WITH A STAGE LOADING FACTOR OF 4 DESIGNED FOR AN INTEGRAL LIFT ENGINE. 2: PERFORMANCE OF 2-, 3- AND 3 1/2-STAGE CONFIGURATIONS
Warren J. Whitney Feb. 1977 28 p refs
(NASA-TM-X-3482; E-8874) Avail: NTIS HC A03/MF A01 CSCL 21E

The stage work distribution among the three stages was very close to the design value. The specific work output-mass flow characteristics of the three stages were closely matched. The efficiency of the 3 1/2 stage turbine at design specific work output and design speed was within 0.008 of the estimated value, and this agreement was felt to demonstrate the adequacy of the prediction method in the high stage loading factor regime. Author

N77-18158*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COLD AIR INVESTIGATION OF 4 1/2-STAGE TURBINE WITH STAGE LOADING FACTOR OF 4.66 AND HIGH SPECIFIC WORK OUTPUT. 1: OVERALL PERFORMANCE
Warren J. Whitney, Frank P. Behning, Thomas P. Moffitt, and Glen M. Hotz Washington Feb. 1977 20 p refs
(NASA-TM-X-3498; E-8967) Avail: NTIS HC A02/MF A01 CSCL 21E

The turbine developed design specific work output at design speed at a total pressure ratio of 6.745 with a corresponding efficiency of 0.855. The efficiency (0.855)was 3.1 points lower than the estimated efficiency quoted by the contractor in the design report and 0.7 of a point lower than that determined by a reference prediction method. The performance of the turbine, which was a forced vortex design, agreed with the performance determined by the prediction method to about the same extent as did the performance of three reference high stage loading factor turbines, which were free vortex designs. Author

N77-18159*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF ENDWALL COOLING ON SECONDARY FLOWS IN TURBINE STATOR VANES
Louis J. Goldman and Kerry L. McLallin 1977 29 p refs Presented at AGARD 49th Propulsion and Energetics Panel Conf., The Hague, 28 Mar. - 4 Apr. 1977
(NASA-TM-X-73568) Avail: NTIS HC A03/MF A01 CSCL 21E

The effect of endwall cooling on the secondary flow behavior and the aerodynamic performance of a core turbine stator vane was determined. The investigation was conducted in a cold-air, full-annular cascade, where three-dimensional effects were obtained. Two endwall cooling configurations were tested. In the first configuration, the cooling holes were oriented so that the coolant was injected in line with the inviscid streamline direction. In the second configuration, the coolant was injected at an angle of 15 deg to the inviscid streamline direction and oriented towards the vane pressure stator. In both cases the stator vanes were solid and uncooled so that the effect of endwall cooling was obtained directly. Total-pressure surveys were taken downstream of the stator vanes over a range of cooling flows at the design, mean-radius, critical velocity ratio of 0.778. Changes in the total-pressure contours downstream of the vanes were used to obtain the effect of endwall cooling on the secondary flows in the stator. Author

N77-18160*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPARATUS AND METHOD FOR REDUCING THERMAL STRESS IN A TURBINE ROTOR Patent Application
J. A. Heller, inventor (to NASA) Filed 4 Mar. 1977 13 p
(NASA-Case-LEW-12232-1; US-Patent-Appl-SN-776029) Avail: NTIS HC A02/MF A01 CSCL 21E

A gas turbine is provided wherein the thermal stresses in the turbine rotor are reduced. The rotor includes a central disc with a peripheral rim, and a plurality of blades extending radially outwardly from the rim, and to reduce thermal stresses, a duct arrangement is provided which selectively directs hot gases from the turbine combustor to the rim during the turbine start-up. The hot gases from the combustor serve to heat the rim, and thus decrease the start-up period necessary to bring the temperature profile of the rotor into the operating temperature range. After the start-up period, the duct arrangement is then used to direct cool gases from the turbine compressor to the rim of the rotor in order to maintain a lower rotor equilibrium temperature. NASA

N77-18161*# Hamilton Standard, Windsor Locks, Conn.
THE INFLUENCE OF FORWARD FLIGHT ON PROPELLER NOISE
B. Magliozzi Feb. 1977 517 p refs
(Contract NAS1-13015)
(NASA-CR-145105) Avail: NTIS HC A22/MF A01 CSCL 20A

The effect of flight on blade surface pressures and propeller noise was reported. There were significant differences in blade surface pressures and far-field noise between static and flight conditions. The static data showed many high-intensity, tone-like peaks whereas the flight data was generally free from tones. The turbulence ingested by the propeller operating statically was dominated by long, thin eddies. In flight the scale of the turbulence was greately reduced from that observed statically. Author

N77-18162# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
THE ENGINE ACTUARIAL SYSTEM M.S. Thesis
Robert J. Carlson and Richard J. Smith Jun. 1976 144 p refs
(AD-A030312; SLSR-7-76A) Avail: NTIS HC A07/MF A01 CSCL 21/5

The purpose of this study was to examine the method for collecting historical engine data and the influence of various managerial decisions on engine workload forecasts. The J79-GE-15 and TF30-PW-7 engines were selected for this study and were assumed to be representative of engines with large and small inventories. The data base was prepared from approximately 180,000 AF Form 1534's (Engine Status Report). The authors concluded that cluster sampling procedures could significantly reduce the number of bases required to report engine failure data. In addition, it was noted that small changes in the managerial decisions which establish planning factors related to flying hour programs, Maximum Operating Time (MOT), Jet Engine Base Maintenance Return Rate (JEBM/RR), and Dependability Index (DI) could significantly affect the actuarial forecast. Further research is recommended to develop a deterministic method of establishing MOT, JEBM/RR, and DI factors. The data handling tools developed by this research are included as appendixes for use by future researchers. Author (GRA)

N77-18012*# Pratt and Whitney Aircraft Group, West Palm Beach, Fla.
VARIABLE STREAM CONTROL ENGINE CONCEPT FOR ADVANCED SUPERSONIC AIRCRAFT: FEATURES AND BENEFITS
Robert A. Howlett *In* NASA. Langley Res. Center Proc. of the SCAR Conf., Part 1 1976 p 341-352 refs (For primary document see N77-17996 09-01)
Avail: NTIS HC A21/MF A01 CSCL 21E

N77-18013*# General Electric Co., Philadelphia, Pa.
ADVANCED SUPERSONIC TECHNOLOGY STUDY: ENGINE PROGRAM SUMMARY. SUPERSONIC PROPULSION: 1971 - 1976
J. N. Krebs *In* NASA Proc. of the SCAR Conf., Part 1 1976 p 353-370 (For primary document see N77-17996 09-01)
Avail: NTIS HC A21/MF A01 CSCL 21E

N77-18014*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPONENT TEST PROGRAM FOR VARIABLE-CYCLE ENGINES
Albert G. Powers, John B. Whitlow, and Leonard E. Stitt *In its* Proc. of the SCAR Conf., Part 1 1976 p 371-385 refs (For primary document see N77-17996 09-01)
Avail: NTIS HC A21/MF A01 CSCL 21E

N77-18015*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SUPERSONIC CRUISE INLETS FOR VARIABLE-CYCLE ENGINES
David N. Bowditch *In its* Proc. of the SCAR Conf., Part 1 1976 p 387-397 refs (For primary document see N77-17996 09-01)
Avail: NTIS HC A21/MF A01 CSCL 21E

N77-18016*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CONTROL OF PROPULSION SYSTEMS FOR SUPERSONIC CRUISE AIRCRAFT
Kirby W. Hiller and Daniel I. Drain *In its* Proc. of the SCAR Conf., Part 1 1976 p 399-415 refs (For primary document see N77-17996 09-01)
Avail: NTIS HC A21/MF A01 CSCL 21E

N77-18017*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
YF-12 PROPULSION RESEARCH PROGRAM AND RESULTS
James A. Albers and Frank V. Olinger *In its* Proc. of the SCAR Conf., Part 1 1976 p 417-456 refs (For primary document see N77-17996 09-01)
Avail: NTIS HC A21/MF A01 CSCL 21E

N77-18018*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPOSITE MATERIALS RESEARCH IN SUPPORT OF SUPERSONIC PROPULSION SYSTEMS
Robert A. Signorelli *In its* Proc. of the SCAR Conf., Part 1 1976 p 457-468 refs (For primary document see N77-17996 09-01)
Avail: NTIS HC A20/MF A01 CSCL 21E

N77-18022*# General Electric Co., Philadelphia, Pa. Aircraft Engine Group.
COANNULAR PLUG NOZZLE NOISE REDUCTION AND IMPACT OF EXHAUST SYSTEM DESIGNS
Robert Lee *In* NASA. Langley Res. Center Proc. of the SCAR Conf., Pt. 2, 1976 20 p (For primary document see N77-18019 09-01)
(Contracts NAS3-18008; NAS3-19777; DOT-OST-30034)
Avail: NTIS HC A23/MF A01 CSCL 20A

N77-18023*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CURRENT RESEARCH IN SONIC-BOOM MINIMIZATION
Christine M. Darden and Robert J. Mack *In its* Proc. of the SCAR Conf., Pt. 2, 1976 17 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 20A

N77-18024*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TECHNOLOGY FOR CONTROLLING EMISSIONS OF OXIDES OF NITROGEN FROM SUPERSONIC CRUISE AIRCRAFT
Gregory M. Reck and Richard A. Rudey *In its* Proc. of the SCAR Conf., Pt. 2, 1976 22 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 21E

N77-18025*# Federal Aviation Administration, Washington, D.C. Office of Environmental Quality.
CONSIDERATIONS OF HIGH ALTITUDE EMISSIONS
Anthony J. Broderick and Nicholas P. Krull *In* NASA. Langley Res. Center Proc. of the SCAR Conf., Pt. 2, 1976 10 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 21E

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N77-18163*# Franklin Inst. Research Labs., Philadelphia, Pa.
WIND TUNNEL TESTS OF THE DYNAMIC CHARACTERISTICS OF THE FLUIDIC RUDDER Final Report, Jun. 1975 - Dec. 1976
Charles A. Belsterling Dec. 1976 46 p refs
(Contract NAS1-13930)
(NASA-CR-145142; F-C4188-1) Avail: NTIS HC A03/MF A01 CSCL 01C

The fourth phase is given of a continuing program to develop the means to stabilize and control aircraft without moving parts or a separate source of power. Previous phases have demonstrated the feasibility of (1) generating adequate control forces on a standard airfoil, (2) controlling those forces with a fluidic amplifier and (3) cascading non-vented fluidic amplifiers operating on ram air supply pressure. The foremost objectives of the fourth phase covered under Part I of this report were to demonstrate a complete force-control system in a wind tunnel environment and to measure its static and dynamic control characteristics. Secondary objectives, covered under Part II, were to evaluate alternate configurations for lift control. The results demonstrate an overall response time of 150 msec, confirming this technology as a viable means for implementing low-cost reliable flight control systems. Author

N77-18164# Cheronis (C. G.), Wheaton, Md.
EQUATING FIN, MOTOR POSITION FEEDBACK AND AIRFRAME ANGULAR ACCELERATION FEEDBACK AUTOPILOTS, OR THE ANGULAR ACCELERATION MODEL
C. G. Cheronis 21 Jul. 1976 26 p Backup document for AIAA Synoptic, "Preliminary Control System Synthesis Using Preferred Feedback States", scheduled for publication in Journal of Aircraft, Jul. 1977
Avail: NTIS HC A03/MF A01

A model is considered that adapts the characteristics of angular acceleration feedback into the autopilot design and demonstrates the utility of the model as an analytical design technique. The fin and rate feedback shaping transfer functions that equate a fin feedback autopilot to an autopilot employing angular acceleration as a feedback signal are presented. Shaping in a simplified lateral acceleration control autopilot is discussed. The rate feedback shaping transfer function is shown for autopilot controlling an aerodynamically unstable airframe an aerodynamically stable airframe. The equivalent lateral acceleration control autopilot using airframe angular acceleration feedback is given. The two are equivalent in that the transfer function is identical for both autopilots. Author

N77-18165# Bristol Univ. (England). Dept: of Aeronautical Engineering.
THE APPLICATION OF PILOT MODELS AND AUTOMATIC RIDE CONTROL TO FLIGHT IN TURBULENCE AND THEIR EFFECTS ON STRUCTURAL LOADS Ph.D. Thesis
Robert Stirling Mar. 1976 292 p refs Sponsored by Sci. Res. Council
Avail: NTIS HC A13/MF A01

Pilot modelling and automatic ride control are applied to simulations of large jet transport aircraft in turbulence. The influence of the pilot on response to turbulence is assessed by the use of fairly simple linear pilot models. In response to pitch rate and load factor stimuli the pilot models in general aggravate the response, particularly at the short period frequency. This is consistent with observed pilot characteristics and suggests that control column movement should be kept to a minimum in turbulence. Automatic control using an inboard wing flap gives a significantly improved ride at all fuselage positions. With load factor feedback the flap is destabilizing, and it is necessary to restore short period damping by pitch rate feedback to elevator. The flap reduces the vertical responsiveness in maneuvering flight, and handling qualities criteria must be considered for both stability and response. Author (ESA)

N77-18166# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
RPV OPERATOR PERFORMANCE WITH VARIOUS FLIGHT CONTROL SYSTEMS DURING A SIMULATED TARGET APPROACH Interim Report, Jan. - Dec. 1975
Mark W. Cannon, Jr. Jun. 1976 34 p refs
(AF Proj. 7233)
(AD-A029004; AMRL-TR-76-33) Avail: NTIS HC A03/MF A01 CSCL 01/3

Operator performance was studied during the simulated target approach phase of an operator-controlled remotely piloted vehicle (RPV) mission. Ten performance parameters were computed as a function of controller type (Self-Organizing, Linear Proportional, Bang-Bang), display delay (0, 0.5 sec, 1 sec), initial cross-track error (1320, 2640, 3690 ft) and type of controller feedback (rate or position). The results of the study showed: (1) a significant advantage of rate feedback over position feedback in most performance measures particularly distance to target at the end of the run. Position feedback allowed small target miss distances for all display delays while rate feedback showed sharply increasing miss distances for delays greater than 0.5 sec; (2) that the self-organizing controller, while showing about the same performance under normal flight conditions, showed significant superiority over conventional autopilots in strongly gusting winds. Such improved performance should always be expected whenever strong deviations from normal equilibrium conditions take place. Realistic scenarios for such conditions will be investigated in a follow-on study. Author (GRA)

N77-18006*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DEVELOPMENT OF LONGITUDINAL HANDLING QUALITIES

CRITERIA FOR LARGE ADVANCED SUPERSONIC AIRCRAFT
Robert W. Sudderth (Boeing Commercial Airplane Co., Seattle) and Walter E. McNeill *In its* Proc. of the SCAR Conf., Part 1 1976 p 171-192 refs (For primary document see N77-17996 09-01)
(Contract NAS2-7966)
Avail: NTIS HC A21/MF A01 CSCL 01C

N77-18007*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
HANDLING QUALITIES ASPECTS OF NASA YF-12 FLIGHT EXPERIENCE
Donald T. Berry, Donald L. Mallick, and Glenn B. Gilyard *In its* Proc. of the SCAR Conf., Part 1 1976 p 193-214 refs (For primary document see N77-17996 09-01)
Avail: NTIS HC A21/MF A01 CSCL 01C

N77-18008*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SIMULATOR STUDY OF THE LOW-SPEED HANDLING QUALITIES OF A SUPERSONIC CRUISE ARROW-WING TRANSPORT CONFIGURATION DURING APPROACH AND LANDING
William D. Grantham, Luat T. Nguyen, M. J. Neubauer, Jr., and Paul M. Smith (Vought Corp., Hampton, Va.) *In its* Proc. of the SCAR Conf., Part 1 1976 p 215-248 refs (For primary document see N77-17996 09-01)
Avail: NTIS HC A21/MF A01 CSCL 01C

N77-18009*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FLEXSTAB: A COMPUTER PROGRAM FOR THE PREDICTION OF LOADS AND STABILITY AND CONTROL OF FLEXIBLE AIRCRAFT
Brian R. Perkin (Boeing Aerospace Co., Seattle) and Larry R. Erickson *In its* Proc. of the SCAR Conf., Part 1 1976 p 249-280 refs (For primary document see N77-17996 09-01)
(Contracts NAS2-5006; NAS2-7729; F33615-72-C-1172; F33615-75-C-3132)
Avail: NTIS HC A21/MF A01 CSCL 01C

N77-18010*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
PROPULSION SYSTEM/FLIGHT CONTROL INTEGRATION FOR SUPERSONIC AIRCRAFT
Paul J. Reukauf and Frank W. Burcham, Jr. *In its* Proc. of the SCAR Conf., Part 1 1976 p 281-302 refs (For primary document see N77-17996 09-01)
Avail: NTIS HC A21/MF A01 CSCL 01C

N77-18011*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FLUTTER SUPPRESSION BY ACTIVE CONTROL AND ITS BENEFITS
Robert V. Doggett, Jr. and James L. Townsend (Boeing Co., Seattle) *In its* Proc. of the SCAR Conf., Part 1 1976 p 303-333 refs (For primary document see N77-17996 09-01)
Avail: NTIS HC A21/MF A01 CSCL 01C

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N77-18167 Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France).
ACCEPTANCE TEST OF THE AGING FACILITY FOR E 32 01 AND E 32 03 ELECTRONIC EQUIPMENT CONSTRUCTED BY THE BALLISTICS AND AERODYNAMIC RESEARCH LABORATORY [RECEPTION TECHNIQUE DE LA BAIE DE VIEILLISSEMENT POUR ELECTRONIQUE E 32 01 ET E 32 03 REALISEE PAR LE LRBA]
Baudry and Boudet 14 Nov. 1975 95 p refs In FRENCH (LRBA-E-1-310-PV-9/SYE) Avail: Issuing Activity

Acceptance tests for an accelerated life test facility (simulator) are described together with its specifications. The facility was used to test electronic equipment for inertial platforms. Detailed results of observations and measurements are presented. ESA

N77-18168*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CHARACTERISTICS OF AN ANECHOIC CHAMBER FOR FAN NOISE TESTING
Joseph A. Wuzyniak, Loretta M. Shaw, and Jefferson D. Essary 1977 32 p refs Presented at the Intern. Gas Turbine Conf., Philadelphia, 25-30 Mar. 1977; sponsored by the Am. Soc. of Mech. Engrs.
(NASA-TM-X-73555; E-8993) Avail: NTIS HC A03/MF A01 CSCL 14B

Acoustical and mechanical design features of NASA Lewis Research Center's engine fan noise facility are described. Acoustic evaluation of the chamber, which is lined with an array of stepped wedges, is described. Results from the evaluation in terms of cut-off frequency and non-anechoic areas near the walls are detailed. Fan models are electrically driven to 20,600 RPM in either the inlet mode or exhaust mode to facilitate study of both fore and aft fan noise. Inlet noise characteristics of the first fan tested are discussed and compared to full-scale levels. Turbulence properties of the inlet flow and acoustic results are compared with and without a turbulence reducing screen over the fan inlet. Author

N77-18169*# McDonnell-Douglas Corp., St. Louis, Mo. Avionics System Engineering.
SAIL PAYLOAD ACCOMMODATIONS STUDY
R. J. Neubaur 4 Mar. 1977 22 p ref
(Contract NAS9-14960)
(NASA-CR-151211; DN-C0612-002) Avail: NTIS HC A02/MF A01 CSCL 14B

Methods for accommodating payloads in SAIL are evaluated. It is concluded that a special payload be used as the standard method for verifying avionics systems and experiments. It is recommended that the baselined North door entrance method be retained for accommodation of flight type payloads. Author

N77-18170*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CALIBRATION OF A PITOT-STATIC RAKE
Hampton P. Stump 1 Mar. 1977 31 p ref
(NASA-TM-X-74016) Avail: NTIS HC A03/MF A01 CSCL 14B

A five-element pitot-static rake was tested to confirm its accuracy and determine its suitability for use at Langley during low-speed tunnel calibration primarily at full-scale tunnel. The rake was tested at one airspeed of 74 miles per hour (33 meters per second) and at pitch and yaw angles of 0 to + or - 20 degrees in 4 deg increments. Author

N77-18171# Technische Hochschule, Aachen (West Germany). Stosswellenlab.
HIGH LIFT-DRAG RATIO HYPERSONIC TESTS AND FLAP HEATING INVESTIGATIONS [HYPERSCHALLVERSUCHE BEI HOHER GLEITZAHL UND KLAPPENERWAERMUNGSUNTERSUCHUNGEN]
H. Groenig and H. Schumacher Bonn DOKZENTBw 1976 43 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(BMVg-FBWT-76-12) Avail: NTIS HC A03/MF A01; DOKZENTBw DM 30

Heat flux and pressure distribution were obtained for a conical wave rider and a flat plate flap model in a shock tunnel at a free stream Mach number of 6.7 for various angles of incidence and flap angles. For the wave rider the heat flux showed good agreement between experiment and theory in the case of the design conditions and deviations in off design states. The experiments with the flap model exhibited regions of separated

flow with oscillations and relatively high heat flux values.
Author (ESA)

N77-18172# European Space Research and Technology Center, Noordwijk (Netherlands). Structures and Thermal Control Div.
EUROPEAN SPACE TRIBOLOGY LABORATORY MANAGEMENT PROCEDURES HANDBOOK
1 Nov. 1976 21 p
(ESA-PSS-06-Issue-2) Avail: NTIS HC A02/MF A01

A description is given of the management structures by which ESTL is operated, the constitution and responsibilities of the management bodies and the key individuals, and the procedures to be used to implement the management policies decided on from time to time by ESA. These procedures are mandatory, and alterations, additions, or amendments to them will be made only with the agreement of the Steering Group acting on behalf of the ESTEC Directorate. Author (ESA)

N77-18173# United Engineers and Constructors, Inc., Boston, Mass.
TEST AND EVALUATION OF A PILOT TWO-STAGE PRECIPITATOR FOR JET ENGINE TEST CELL EXHAUST GAS CLEANING
Apr. 1976 115 p refs
(Contracts N62467-74-C-0161; N00025-72-C-0037)
(AD-A030100) Avail: NTIS HC A06/MF A01 CSCL 13/2

Findings of a study for the abatement of air pollution caused by operation of Naval jet engine test facilities, issued in August 1973, were that the use of fuel additives, the retrofit of smokeless combustors and the installation of gas cleaning equipment were potential means of controlling particulate emissions from the cells. Additives and smokeless combustors were found to require additional development leaving exhaust gas cleaning as the only technology then available for emission control. A two-stage electrostatic precipitator was recommended as the most viable alternative to a concept then being actively developed, the cross-flow wet scrubber. Due to the unique nature of the application and the hgih cost of full-sized equipment, it was recommended that a bench scale precipitator be tested to confirm performance and establish size parameters. Such a prototype unit was subsequently installed at Black Point test cell No. 1, Naval Air Rework Facility, Jacksonville, Florida and underwent a sequence of performance and operating tests under the supervision of UE and C. This report summarizes the results of the test program and provides data on the economics of applying a full-scale system to a jet engine test cell. GRA

N77-18174# Coastal Engineering Research Center, Fort Belvoir, Va.
WIND-GENERATED WAVES FOR LABORATORY STUDIES
D. Lee Harris Aug. 1976 47 p refs
(AD-A029639; CERC-TP-76-12) Avail: NTIS HC A03/MF A01 CSCL 08/3

Mechanically generated, regular waves are used in laboratory wave basins and channels for testing engineering designs for the coastal zone. Wind-generated waves in the laboratory display irregularity, suggestive of the irregularity of the open sea. It has been suggested that the validity of laboratory tests would be increased if the laboratory waves were generated by wind. Examination of a simple approach to wave forecasting, based on dimensional analysis, leads to the conclusion that wind-generated waves in the laboratory cannot be expected to have the same form as prototype waves unless they correspond to equivalent scaled fetches. Very low windspeeds must be used to produce waves that are anywhere near fully developed in a laboratory facility of moderate length. The resulting waves are too small to be of much value in testing designs. An examination of the microscale procedures, now believed to be responsible for wave growth and of some secondary flow characteristics of wind tunnels, indicates that the relative importance of the mechanisms for wave generation in wind channels is very different from that in unconfined airspaces. GRA

N77-18175# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
AUTOMATED PROCEDURE FOR EVALUATING SITES FOR SUITABILITY AS HELICOPTER LANDING ZONES. VOLUME 1: DESCRIPTIONS AND INSTRUCTIONS FOR USE OF COMPUTER PROGRAMS Final Report, Jan. 1973 - Jun. 1975
Judith A. Parks Jun. 1976 282 p refs
(DA Proj. 4A1-62121-AT-31; DA Proj. 1T1-62112-A-528)
(AD-A030173; WES-Instruction-M-76-1) Avail: NTIS HC A13/MF A01 CSCL 01/5

This report contains instructions for operating a model that is an automated procedure for evaluating designated sites as helicopter landing zones. The model is comprised of three independent computer programs run sequentially. Program 1 (FTHEL) evaluates the site in terms of generalized conditions of slope, microrelief, and soil strength as related to the requirements set by certain characteristics of the helicopter that is to land. The program determines whether the site can provide a full-touch zone, a skid-touch zone, a nontouch zone, or no landing zone at all, and computes the minimum departure angle for the specified helicopter if a landing zone is possible. Program 2 (FTJPRH) is an automated mathematical procedure for predicting the size and shape of a clearing in a forested area by considering blast forces from a bomb explosion, tree stem strength, stem diameter, and distance from ground zero (GZ), the center of the explosion. The clearing is described by a vegetation profile of tree remnant height versus the distance from GZ. Program 3 (FTJPHL) of the model is an automated procedure for evaluating a clearing by estimating how many trees must be removed from a clearing produced by a high-yield, air-dropped munition in order to use the clearing as a full-touch helicopter landing zone. The output is the number of tree remnants that must be removed to satisfy the landing requirements of a specified helicopter.
GRA

N77-18176# Naval Postgraduate School, Monterey, Calif.
DEVELOPMENT OF A TEMPERATURE-PNEUMATIC PROBE AND APPLICATION AT THE ROTOR EXIT IN A TRANSONIC COMPRESSOR M.S. Thesis
Frederick James Dodge Jun. 1976 118 p refs
(AD-A029974) Avail: NTIS HC A06/MF A01 CSCL 14/2

The development is reported of a new combination temperature-pneumatic probe specifically to determine the blade element performance of the rotor in a transonic compressor. The design incorporates a fine wire thermocouple sensor which provides a measure of temperature rise that is insensitive to Mach number. With simultaneous measurements from four pneumatic sensors, the velocity vector was determined locally in radial surveys downstream of the compressor rotor. The probe was calibrated in a free jet. The calibration measurements were reduced to a set of equations to allow off-line reduction of compressor measurements using a Hewlett-Packard Model 9830A calculator and peripherals. The design, development, calibration, and application of the probe are described and initial results of measurements in the compressor are given. GRA

N77-18177# Naval Postgraduate School, Monterey, Calif.
BALLISTIC RANGE DEVELOPMENT M.S. Thesis
Thomas James Davis Jun. 1976 101 p refs
(AD-A030086) Avail: NTIS HC A06/MF A01 CSCL 14/2

A ballistic range was developed for use in testing structural materials. High velocity and low velocity guns were investigated. Charge values for various projectile weights were determined and velocity consistency and reproducibility were verified. A range notebook was compiled with necessary user information and test results. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N77-18178*# TRW Systems Group, Redondo Beach, Calif. Systems Analysis Section.
FORMULATION OF CONSUMABLES MANAGEMENT MODELS: MISSION PLANNING PROCESSOR PAYLOAD INTERFACE DEFINITION
J. G. Torian 28 Jan. 1977 58 p refs
(Contract NAS9-14264)
(NASA-CR-151208; TRW-26821-H011-R0-00) Avail: NTIS

HC A04/MF A01 CSCL 22A

Consumables models required for the mission planning and scheduling function are formulated. The relation of the models to prelaunch, onboard, ground support, and postmission functions for the space transportation systems is established. Analytical models consisting of an orbiter planning processor with consumables data base is developed. A method of recognizing potential constraint violations in both the planning and flight operations functions, and a flight data file storage/retrieval of information over an extended period which interfaces with a flight operations processor for monitoring of the actual flights is presented. Author

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

No abstracts in this category.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N77-18179*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SIMULATOR FOR PRACTICING THE MATING OF AN OBSERVER-CONTROLLED OBJECT WITH A TARGET Patent Application

Walter J. Polstorff, inventor (to NASA) Filed 25 Feb. 1977 25 p

(NASA-Case-MFS-23052-2; US-Patent-Appl-SN-772165) Avail: NTIS HC A02/MF A01 CSCL 14B

A servo controlled target replica, and a surface bearing a computer generated line drawing of an object are individually viewed by separate television cameras. This allowed a two-dimensional composite of the target replica and the object to be displayed on a monitor simulating what an observer would see through a window in a spacecraft. The target replica is coded along one self coordinate axis in such a way that the distance of an elemental area on the target along the axis is capable of being remotely readout by a television camera. The code is by way of a variation in color (i.e., wavelength) or in brightness (or a combination of color or brightness). NASA

N77-18180# Instituto Nacional de Tecnica Aeroespacial, Madrid (Spain).

[RESEARCH ACTIVITIES OF THE SPANISH NATIONAL AEROSPACE INSTITUTE] Annual Report, 1975

1976 44 p In SPANISH Original contains color photographs Avail: NTIS HC A03/MF A01

The survey presented describes activities in the fields of structural dynamics, propulsion, missiles, materials tests, oil derivatives, and satellite tracking station (Madrid and Las Palmas). ESA

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N77-18181*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

IMS DIRECTORY OF SPACECRAFT AND EXPERIMENT SCIENTIFIC CONTACTS

Jan. 1977 190 p

(NASA-TM-X-72606; Rept-9; B16321-0001) Avail: NTIS HC A09/MF A01 CSCL 22A

The various observations by experiments on balloons, rockets, aircraft, ships, ground-based stations, and satellites are coordinated. The information on achieved measurements of balloons, rockets, aircraft, and ships are presented. Only those satellites and experiments for which some data were acquired in 1976 are included. Experiments that provide monitoring of the solar electromagnetic spectrum, such as those on Solrad 11A and 11B, were included. Heliocentric satellites orbiting inside the orbit of the earth are included. Author

N77-18182*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THERMODYNAMIC DATA REPORT FOR THE TITAN/CENTAUR TC-5 EXTENDED MISSION

Raymond F. Lacovic Jan. 1977 47 p

(NASA-TM-X-73605; E-9080) Avail: NTIS HC A03/MF A01 CSCL 22B

The Titan/Centaur vehicle, with the Helios B spacecraft, was launched on January 15, 1976. After the spacecraft was placed into its desired heliocentric trajectory, the Centaur vehicle continued into an extended mission to perform experiments demonstrating increased operational capabilities. The thermal performance of all pertinent Centaur systems and components was evaluated and its capability for satisfactory operation for long duration space coasts was verified. The selected thermal control techniques maintained the Centaur component temperatures within their qualification limits for the entire 8-hour and 22-minute duration of the extended mission. Author

N77-18183*# Dayton Univ. Research Inst., Ohio.

UTILIZATION OF SATELLITE IMAGERY BY IN-FLIGHT AIRCRAFT

James K. Luers Huntsville, Ala. NASA Dec. 1976 29 p refs

(Contract NAS8-31294)

(NASA-CR-150185) Avail: NTIS HC A03/MF A01 CSCL 22A

Present and future utilization of satellite weather data by commercial aircraft while in flight was assessed. Weather information of interest to aviation that is available or will become available with future geostationary satellites includes the following: severe weather areas, jet stream location, weather observation at destination airport, fog areas, and vertical temperature profiles. Utilization of this information by in-flight aircraft is especially beneficial for flights over the oceans or over remote land areas where surface-based observations and communications are sparse and inadequate. Author

N77-18184# Royal Aircraft Establishment, Farnborough (England).

MIRANDA: OPERATIONS FOR TWO ELECTRONICALLY DISTURBED PASSES

M. J. Hammond, E. A. R. Anstey, and E. Jones Feb. 1976 43 p refs

(RAE-TR-76017; BR52041) Avail: NTIS HC A03/MF A01

The operational activities at the RAE Satellite Control Center on the mornings of 10 March and 21 May 1974, when the Miranda satellite was in an 'electronically disturbed' state are described. The controller returned the satellite to its planned state using automatic techniques within the timescale of each pass and thus prevented possible mission failure. Author (ESA)

N77-18185# National Aerospace Lab., Amsterdam (Netherlands). Space Flight Div.

IN-ORBIT EXPERIMENT WITH AN ATTITUDE CONTROL ALGORITHM FOR ANS BASED ON MODERN CONTROL PRINCIPLES

J. J. M. Prins Apr. 1976 73 p refs

(Contract NIVR-1781)

(NLR-TR-76040-U) Avail: NTIS HC A04/MF A01

The existing fine attitude system of the Astronomical Netheriands Satellite was designed on the basis of conventional digital control techniques. The possibility of a more advanced approach is presented. As an example, an alternative control algorithm for the scan mode was developed with the use of state estimation and state variable feedback techniques. The results of computer simulations and in-orbit tests are presented. The in-orbit test results show a marked performance improvement in terms of reduced settling time after slew and reduced sensitivity to disturbance torques. Computer simulations indicate a potential for further performance improvements. Author (ESA)

N77-18186# National Aerospace Lab., Amsterdam (Netherlands).
PARAMETER ESTIMATION IN MATHEMATICAL MODELS OF THE ESRO 1A ATTITUDE DYNAMICS (INCLUDING ATMOSPHERIC EFFECTS) USING NUMERICAL DIFFERENTIATION OF MEASURED DATA WITH SMOOTHING SPLINES
J. W. Boerstoel, G. H. Huizing, and P. T. L. M. vanWoerkom 22 Sep. 1976 57 p refs
(Contract ESOC-592/73-AR)
(NLR-TR-76126-C; ESA-CR(P)-889) Avail: NTIS HC A04/MF A01

Measured data of the attitude dynamics and the orbit of the ESRO 1A spacecraft were used for the development of a mathematical model for the attitude behavior of the spacecraft, including, in particular, the aerodynamic interaction with the atmosphere of the earth. The attitude behavior was determined by two strong permanent magnets aligning the spacecraft along the magnetic field lines of the earth, by a damping system with magnetic hysteresis rods, by the gravity gradient, and by the atmospheric interaction. A mathematical model for the attitude dynamics is presented. The model of the damping by the magnetic hysteresis rods, which was developed and used in previous studies was improved. A model for the atmospheric interaction is proposed. The mathematical model contains unknown parameters, which were estimated by fitting the Euler equations for the attitude behavior to processed measured attitude and orbit data. These processed data were obtained by data reduction algorithm, in which numerical differentiation of measured data with smoothing splines plays a critical role. The estimation of the parameters in the model, which determine the model aerodynamic torques and the model torques of the hysteresis rods, turned out to be unsatisfactory. It is shown that this can be explained by bias in the processed data, caused by numerical differentiation with smoothing splines. Due to this bias, the torques computed from the data contain errors of the same order of magnitude as the relatively small aerodynamic and hysteresis torques. It is evident, that the validity of the modeling fo the aerodynamic torques and of the torques generated by the hysteresis rods cannot be established with the present data reduction algorithms. It is concluded that, given the low level of torques to be fitted, alternative ways of numerical differentiation should be considered in order to improve the results. These are briefly indicated. Author (ESA)

N77-18187# Societe Nationale Industrielle Aerospatiale, Cannes (France). Div. Systemes Balistiques et Spatiaux.
STUDY OF ATTITUDE CONTROL SYSTEMS USING THE ESA DIGITAL ONBOARD COMPUTER, VOLUME 1 Final Report [ETUDE DE SYSTEMES DE CONTROLE D'ATTITUDE UTILISANT LE CALCULATEUR EMBARQUE DE L'ESA]
C. Morel, A. Mortelette, P. Brunet, G. Lebegue, J. C. Grand, G. Mailfert, J. P. Monnier, P. Baduel, P. Contensou, J. Willien et al 30 Aug. 1976 197 p In FRENCH 2 Vol.
(Contract ESTEC-2103/73)
(ESA-CR(P)-869-Vol-1; Rept-600-CA/69-Vol-1) Avail: NTIS HC A09/MF A01

The application of an onboard computer to satellite attitude control using optimal control procedures was investigated. A mathematical 3-axis simulation permits validating the system and evaluating its performance. The use of the computer for orbit control is discussed. Control loops on the simulator of the computer were used to investigate problems in conception, development, and implementation of the software of an attitude control system. The utilization of the computer logic for detection and analysis of system breakdowns is discussed. ESA

N77-18188# Centre National d'Etudes Spatiales, Toulouse (France).
DATA PROCESSING FOR ATTITUDE STABILIZATION OF CASTOR (D5B) [LES TRAITEMENTS DE RESTITUTION D'ATTITUDE DE CASTOR (D5B)]
Guy Oyharcabal Aug. 1976 32 p refs In FRENCH; ENGLISH summary
(CNES-NT-44) Avail: NTIS HC A03/MF A01

Data processing for the satellite is discussed. The angular velocity of the spin stabilized satellite needs to be controlled; also, all the attitude parameters should be determined during in-flight calibration of the CACTUS micro-accelerometer and during scientific processing of data yielded by the accelerometers. The most elaborate data processing procedure makes use of a mathematical model of satellite motion and adjustment of some parameters by a differential correction method. ESA

N77-18189# Boston Univ., Mass.
PROCEEDINGS OF THE SYMPOSIUM OF THE COSPAR SATELLITE BEACON GROUP ON THE GEOPHYSICAL USE OF SATELLITE BEACON OBSERVATIONS Final Report
Michael Mendillo 4 Jun. 1976 757 p refs Held at Boston, 1-4 Jun. 1976 Sponsored in part by COSPAR and Intern. Union of Radio Sci.
(Contract F19628-76-C-0128; AF Proj. 4643)
(AD-A030824; AFGL-TR-76-0237) Avail: NTIS HC A99/MF A01 CSCL 17/7

This report contains the completed papers presented at the COSPAR Satellite Beacon Symposium of June 1976. The topics of the papers were ionospheric structure and dynamics, ATS-6 results, disturbed f region, scintillation and irregularities and specification of trans ionospheric functions for engineering purposes. Author (GRA)

N77-18190# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
ON CAPACITY ALLOCATION STRATEGIES FOR DOD COMMUNICATION SATELLITES Final Report, Jan. 1975 - Jan. 1976
Joseph M. Aein and Ostap S. Kosovych Jan. 1976 315 p refs
(Contract DAHC15-73-C-0200)
(AD-A030796; P-1155; IDA/HQ-75-17866) Avail: NTIS HC A14/MF A01 CSCL 17/2

Several allocation strategies are investigated for sharing the satellite capacity among user communities requiring circuit-switched or store-and-forward (message-switched) communication service. Teletraffic and queueing models are used to obtain analytical results by which the allocation strategies are compared. It is shown that the capacity required to provide a specified grade of service is strongly dependent upon the particular allocation strategy chosen. Therefore, an allocation strategy can be selected which requires less capacity and hence provides more efficient utilization of the satellite capacity for a specified grade of service. Author (GRA)

N77-18191# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
A BIT TIMING EXTRACTION TECHNIQUE Final Report, Aug. 1975 - Feb. 1976
James J. Foshee Jun. 1976 67 p refs
(AF Proj. 1227)
(AD-A031207; AFAL-TR-76-149) Avail: NTIS HC A04/MF A01 CSCL 17/2

This technical report contains a description of a bit-timing extraction technique which can be used to derive bit-timing (a clock) from a UHF satellite digital communications channel disturbed by the effects of ionospheric scintillation. The bit-timing extraction technique is described as a part of a modulator/demodulator which uses a binary FSK modulator and a post-detection demodulator. In addition a convolutional encoder with a feedback decoder are an integral part of the modulator/demodulator. The functioning of the encoder-decoder requires an accurate clock even during signal fading periods of up to five seconds. The bit-timing extraction technique was conceived to fulfill this need. Author (GRA)

N77-18192# Federal Electric Corp., Vandenberg AFB, Calif.
UTILIZATION OF A PRIORI ESTIMATES IN ICBM TRAJECTORY DETERMINATION Final Report
Russell E. Roy 11 Mar. 1976 19 p refs
(Contract F04701-72-C-0203)
(AD-A029568; SAMTEC-TR-76-77) Avail: NTIS HC A02/MF A01 CSCL 16/2

There are two particular linear estimation techniques frequently used by various agencies and test ranges to derive ICBM trajectory coordinates from both test range tracker measurements and 'a priori' estimates of parameters pertinent to accurate trajectory solutions. Whenever each of the techniques is applied to the same set of tracker measurements and 'a priori' estimates, significantly different trajectory solutions and solution uncertainties are obtained. This disturbing fact has motivated an analysis and comparison of the techniques that are of major interest in this report. An expository account of the techniques that consists of development, description, and discussion of their basic structures is presented. The material is intended to provide information or knowledge that can be of use when either of the techniques is a candidate for trajectory estimation problems, and to reveal pertinent rationale that accompany solutions derived from each technique. Author (GRA)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N77-18193*# General Electric Co., Philadelphia, Pa. Space Div.
EVAL SYSTEM CONCEPT DEFINITION. PARTIAL SPACELAB PAYLOAD, APPENDICES
30 Sep. 1976 99 p Revised
(Contract NAS5-24022)
(NASA-CR-152430; Doc-76SDS4269-Amend-152) Avail: NTIS HC A05/MF A01 CSCL 22B

Tables and charts are presented for experiment schematics, mission opportunities, mission timelines, crew time line and power profile. The methodology being developed to evaluate cost effective vibroacoustic test plans for a representative EVAL shuttle spacelab payload is analyzed. Statistical decision theory is used to quantitatively evaluate seven alternate test plans which include component, subassembly, or payload testing and combinations of component assembly testing. S.M.

N77-18194*# General Electric Co., Philadelphia, Pa. Space Div.
EVAL SYSTEM CONCEPT DEFINITION. PARTIAL SPACELAB PAYLOAD
30 Sep. 1976 95 p refs
(Contract NAS5-24022)
(NASA-CR-152431; Doc-76SDS4269) Avail: NTIS HC A05/MF A01 CSCL 22B

The preliminary design of an earth-viewing spacelab payload, with accommodations shared by both NASA and ESA is addressed. Mission parameters for this flight include a launch date of September 1981, an inclination of 57 deg, and an orbital altitude of 325 km. A seven-day mission is planned. The NASA portion of this payload is assigned to the EVAL (Earth Viewing Applications Laboratory) program. The ESA complement is designed as a multiuser payload. Author

N77-18195*# General Electric Co., Philadelphia, Pa. Space Div.
EARTH VIEWING APPLICATIONS LABORATORY (EVAL). DEDICATED PAYLOAD, STANDARD TEST RACK PAYLOAD, SENSOR MODIFICATIONS Final Report
27 Dec. 1976 192 p refs
(Contract NAS5-23412)
(NASA-CR-152432; Doc-76SDS4284) Avail: NTIS HC A09/MF A01 CSCL 22B

The preliminary analysis of strawman earth-viewing shuttle sortie payloads begun with the partial spacelab payload was analyzed. The payloads analyzed represent the two extremes of shuttle sortie application payloads: a full shuttle sortie payload dedicated to earth-viewing applications, and a small structure payload which can fly on a space available basis with another primary shuttle payload such as a free flying satellite. The intent of the dedicated mission analysis was to configure an ambitious, but feasible, payload; which, while rich in scientific return, would also stress the system and reveal any deficiences or problem areas in mission planning, support equipment, and operations. Conversely, the intent of the small structure payload was to demonstrate the ease with which a small, simple, flexible payload can be accommodated on shuttle flights. Author

N77-18196*# TRW Defense and Space Systems Group, Redondo Beach, Calif. Systems Analysis Section.
FORMULATION OF CONSUMABLES MANAGEMENT MODELS: CONSUMABLES FLIGHT PLANNING WORKSHEET UPDATE
C. M. Newman 28 Jan. 1977 47 p refs
(Contract NAS9-14264)
(NASA-CR-151188; TRW-26821-H010-R0-00) Avail: NTIS HC A03/MF A01 CSCL 22A

The updated consumables flight planning worksheet (CFPWS) is documented. The update includes: (1) additional consumables: ECLSS ammonia, APU propellant, HYD water; (2) additional on orbit activity for development flight instrumentation (DFI); (3) updated use factors for all consumables; and (4) sources and derivations of the use factors. Author

N77-18197*# TRW Defense and Space Systems Group, Redondo Beach, Calif. Systems Analysis Section.
FORMULATION OF CONSUMABLES MANAGEMENT MODELS. DEVELOPMENT APPROACH FOR THE MISSION PLANNING PROCESSOR WORKING MODEL
L. C. Connelly 14 Jan. 1977 27 p refs
(Contract NAS9-14264)
(NASA-CR-151177; TRW-26821-H009-R0-00) Avail: NTIS HC A03/MF A01 CSCL 22A

The mission planning processor is a user oriented tool for consumables management and is part of the total consumables subsystem management concept. The approach to be used in developing a working model of the mission planning processor is documented. The approach includes top-down design, structured programming techniques, and application of NASA approved software development standards. This development approach: (1) promotes cost effective software development, (2) enhances the quality and reliability of the working model, (3) encourages the sharing of the working model through a standard approach, and (4) promotes portability of the working model to other computer systems. Author

N77-18198*# TRW Systems Group, Redondo Beach, Calif.
SPACE SHUTTLE NAVIGATION FILTER DEVELOPMENT Final Report
W. M. Lear 3 Aug. 1976 7 p refs
(Contract NAS9-14330)
(NASA-CR-151178; TRW-1780.1.76-7632) Avail: NTIS HC A02/MF A01 CSCL 22B

Problems encountered in developing a high speed trajectory data processor for the shuttle ascent and entry phases are described. The development of a 19 state acceleration filter for the processor is reported. Author

N77-18199*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SHUTTLE/TETHERED SATELLITE SYSTEM CONCEPTUAL DESIGN STUDY
Dec. 1976 190 p refs
(NASA-TM-X-73365) Avail: NTIS HC A09/MF A01 CSCL 22A

A closed-loop control system was added to the tether reel which improves control over the tethered satellite. In addition to increasing the stability of the tethered satellite along local vertical, this control system is used for deployment and retrieval of tethered satellites. This conceptual design study describes a tether system for suspending a science payload at an altitude of 120 km from space shuttle orbiter flying at an altitude of 200 km. In addition to the hardware conceptual designs, various

aspects concerning Orbiter accommodations are discussed.
Author

N77-18200*# Lockheed Missiles and Space Co., Huntsville, Ala.
EXTENDED APPLICATIONS STUDY OF AMOOS AND AMRS Final Report
John White Jan. 1977 139 p refs
(Contract NAS8-31997)
(NASA-CR-150195; LMSC-HREC-TR-D497150) Avail: NTIS HC A07/MF A01 CSCL 22B

The potential advantages of the Aeromaneuvering Orbit-to-Orbit Shuttle (AMOOS) over the all-propulsive Orbit Transfer Vehicle (OTV) are shown. In particular, the kit concept studies and the dual fueled AMOOS studies show its versatility and option potential over the all-propulsive vehicle. All of this potential of AMOOS and the Aeromaneuvering Recovery System (AMRS) depends upon the ability to control the trajectory during atmospheric flight and so use an ablative TPS. In turn, this TPS must be light weight, which can be attained by spraying a lightweight ablator directly onto the load bearing skin. Author

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N77-18201# Mitre Corp., Bedford, Mass.
MOVING TARGET INDICATION USING THE SNAPSHOT ALGORITHM
J. E. Barry Sep. 1976 57 p refs
(Contract F19628-76-C-0001)
(AD-A031152; MTR-3070; ESD-TR-76-157) Avail: NTIS HC A04/MF A01 CSCL 15/3

This document is the first in a series of three describing the digital real-time 'snapshot' moving target indication (MTI) technique developed for the GEODSS project in FY75. GEODSS is a Ground-based Electro-Optical Deep Space Surveillance system for the detection of satellites at altitudes exceeding 3,000 nautical miles. The purpose of this document is to describe the snapshot MTI algorithms in the context of the GEODSS system. GRA

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N77-18202*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TESTING OF TYPICAL SPACECRAFT MATERIALS IN A SIMULATED SUBSTORM ENVIRONMENT
N. John Stephens, Frank D. Berkopec, John V. Staskus, Richard A. Blech, and Steven J. Narciso 1976 27 p refs Presented at the Spacecraft Charging Technology Conf., Colorado Springs, 27-29 Oct. 1976; cosponsored by the USAF and NASA
(NASA-TM-X-73603; E-8970-4) Avail: NTIS HC A03/MF A01 CSCL 22B

An investigation to determine spacecraft materials characteristics under charging conditions was conducted at the Lewis Research Center substorm simulation facility. The test specimens were spacecraft paints, silvered Teflon, thermal blankets and solar array segments. The samples, ranging in size from 300 to 1,000 sq cm were exposed to monoenergetic electron energies from 2 to 20 keV at a current density of 1 nA sq cm. The samples generally behaved as capacitors with strong voltage gradients at their edges. The charging characteristics of the silvered Teflon, Kapton, and solar cell covers were controlled by the secondary emission characteristics. Insulators that did not discharge were the spacecraft paints and the quartz fiber cloth thermal blanket sample. All other samples did experience discharges when the surface voltage reached -8 to -16 kV. The discharges were photographed. The breakdown voltage for each sample was determined and the average energy lost in the discharge was computed. Author

N77-18203# Weiler Research, Inc., Mountain View, Calif.
POESSY: A COMPUTER PROGRAM FOR THE AUTOMATIC GENERATION OF REENTRY VEHICLE NOSE TIP FINITE ELEMENT MODELS Final Report, Jun. 1974 - Apr. 1976
Frank C. Weiler Wright-Patterson AFB, Ohio AFML Jun. 1976 103 p refs
(Contract F33615-74-C-0193; AF Proj. 627A)
(AD-A031008; AFML-TR-76-85) Avail: NTIS HC A06/MF A01 CSCL 16/3

The theoretical background of the automatic nose tip finite element model generator, POESSY, is described. The POESSY computer program consists of four basic subprograms which perform different distinct steps in the automatic generation and translation of nose tip models. They are PGMESH which automatically generates the structural finite element mesh, PGPRES which translates the surface pressures and temperatures, PGTEMP which translates the indepth 2-dimensional temperature field and PGPLOT which plots the resultant finite element mesh and temperature contours. The POESSY code is designed to accept the output data from a thermochemical ablation, shape change, in-depth temperature response computer code and prepare it for input to a thermostructural analysis computer code with a minimum amount of effort by the user. The use of the POESSY computer program is demonstrated by sample problems solved for a typical plug and shell nose tip. Author (GRA)

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N77-18204*# General Electric Co., Philadelphia, Pa. Space Div.
SPACE SHUTTLE EARTH OBSERVATION SENSORS POINTING AND STABILIZATION REQUIREMENTS STUDY
7 May 1976 107 p
(Contract NAS5-24022)
(NASA-CR-152434; Doc-76SDS4228) Avail: NTIS HC A06/MF A01 CSCL 14B

The shuttle orbiter inertial measurement unit (IMU), located in the orbiter cabin, is used to supply inertial attitude reference signals; and, in conjunction with the onboard navigation system, can provide a pointing capability of the navigation base accurate to within plus or minus 0.5 deg for earth viewing missions. This pointing accuracy can degrade to approximately plus or minus 2.0 deg for payloads located in the aft bay due to structural flexure of the shuttle vehicle, payload structural and mounting misalignments, and calibration errors with respect to the navigation base. Drawbacks to obtaining pointing accuracy by using the orbiter RCS jets are discussed. Supplemental electromechanical pointing systems are developed to provide independent pointing for individual sensors, or sensor groupings. The missions considered and the sensors required for these missions and the parameters of each sensor are described. Assumptions made to derive pointing and stabilization requirements are delineated.
Author

N77-18205*# SCI Systems, Inc., Huntsville, Ala.
PHASE 2 DESIGN STUDY OF THE ELECTRONIC ASSEMBLY FOR THE HRUV SPECTROMETER/POLARIMETER INTENDED FOR THE SOLAR MAXIMUM MISSION. IMPLE-

MENTATION PHASE PROGRAM PLAN, REVISION A
18 Jan. 1977 45 p
(Contract NAS8-32035)
(NASA-CR-150191) Avail: NTIS HC A03/MF A01 CSCL 14B

The primary function of the implementation phase is to convert the ERA design of the design study phase into deliverable flight hardware. The development aspects of the experiment logic unit, the dual power converter, the junction box and the cables are considered. Author

N77-18206*# SCI Systems, Inc., Huntsville, Ala.
RELIABILITY PROGRAM PLAN FOR THE ELECTRONICS ASSEMBLY FOR THE HRUV SPECTROMETER/ POLARIMETER INTENDED FOR THE SOLAR MAXIMUM MISSION
Jan. 1977 27 p refs Revised
(Contract NAS8-32035)
(NASA-CR-150192) Avail: NTIS HC A03/MF A01 CSCL 14B

The reliability program consists of: parts stress analysis, failure mode, effect and criticality analysis, standardization of design practices, and a design review program. Malfunction reporting, and failure analysis is delineated, as well as identification of inputs and outputs. S.M.

N77-18207*# SCI Systems, Inc., Huntsville, Ala.
QUALITY ASSURANCE PLAN FOR SOLAR MAXIMUM MISSION (SSM) INSTRUMENTS ELECTRONIC ASSEMBLY - HRUV SPECTROMETER/POLARIMETER
Dec. 1976 44 p Revised
(Contract NAS8-32035)
(NASA-CR-150193) Avail: NTIS HC A03/MF A01 CSCL 14B

The quality assurance program demonstrates recognition of the quality aspects and an organized approach to achieve them. It ensures that quality requirements are determined and satisfied throughout all phases of contract performance, including preliminary and engineering design, development, fabrication, processing, assembly, inspection, test, checkout, packaging, shipping, storage, maintenance field use, flight preparations, flight operations and post-flight analysis, as applicable. Author

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N77-18208# United Technologies Corp., Windsor Locks, Conn. Hamilton Standard Div.
ROCKET ENGINE ASSEMBLIES AND GAS GENERATOR PLENUM, REVISION A Final Report
H. Garfinkel 30 Sep. 1976 9 p Revised
(Contract N00014-75-C-1078)
(AD-A030595; SP-01R76-Rev-A) Avail: NTIS HC A02/MF A01 CSCL 22/2

The Final Program Report has been prepared to satisfy the Contract Data Requirements List, Item A002, of Contract Number N00014-75-C-1078 Modification Number P00001. This contract, including Modification Numbers P00001 and P00002, covers the delivery of monopropellant rocket engines, refurbishment of certain thrusters to incorporate chamber heaters and heat shields, and delivery of a gas generator/plenum system for the Multiple Satellite Dispenser for the Naval Research Laboratory. This report summarizes all work accomplished under the contract and serves as an index to the program. Detail description and content of the summarized reports shall be found in the referenced documents. Author (GRA)

N77-18209# Ogden Air Logistics Center, Hill AFB, Utah. Propellant Lab. Section.
MINUTEMAN STAGE 1 MOTOR RELIABILITY IMPROVEMENT PROGRAM SURVEILLANCE
John A. Thompson Sep. 1976 30 p refs
(AD-A030640; MANCP-354(76)) Avail: NTIS HC A03/MF A01 CSCL 21/9

This report contains data and test results from the third time testing of the Minuteman Stage I Reliability Improvement Program (RIP) Surveillance. Thiokol (see TWR-7300) had tested and reported on this program for eight years up through 30 June 1973. The responsibility was then turned over to the Propellant Laboratory (MANCP) at OO-ALC. In the previous report, data were compared with Thiokol data and were presented in the same format as in Thiokol's final report. In this report, Thiokol's data with the data from three years of testing in MANCP's laboratory were combined and regression analysis was made by MANCP's statistical group. The purpose of testing is to provide early warning if any serious degradation trends occur in the components being evaluated. Author (GRA)

N77-18210*# ARO, Inc., Arnold Air Force Station, Tenn.
STUDIES OF THE EXHAUST PRODUCTS FROM SOLID PROPELLANT ROCKET MOTORS Final Report, 1 Jul. 1973 - 30 Jun. 1975
R. Dawbarn and M. Kinslow AEDC Sep. 1976 115 p refs Sponsored in part by NASA
(AF Proj. 921E; ARO Proj. V34P-05A)
(NASA-CR-149674; AD-A029569; AEDC-TR-76-49; ARO-VKF-TR-75-112) Avail: NTIS HC A06/MF A01 CSCL 21/8

This study was undertaken to determine the feasibility of conducting environmental chamber tests on the physical processes which occur when a solid rocket motor exhaust mixes with the ambient atmosphere. Of particular interest was the interaction between hydrogen chloride, aluminum oxide, and water vapor. The program consisted of three phases: (1) building a small rocket motor and using it to provide the exhaust species in a controlled environment; (2) evaluating instruments used to detect and measure HCl concentrations and if possible determining whether the HCl existed in the gaseous state or as an acid aerosol; (3) monitoring a series of 6.4-percent scale space shuttle motor tests and comparing the results to the environmental chamber studies. Eighteen firings were conducted in an environmental chamber with the initial ambient relative humidity set at values from 29 to 100 percent. Two additional firings were made in a large shed, and four were made on an open concrete apron. Six test firings at MSFC were monitored, and the ground level concentrations are reported. Evidence is presented which shows that the larger Al2O3 (5 to 50 micrometers) particles from the rocket motor can act as condensation nuclei. Under appropriate ambient conditions where there is sufficient water vapor this results in the formation of an acid aerosol. Droplets of this acid were detected both in the environmental chamber and in the scaled shuttle engine tests. GRA

N77-18211# Ogden Air Logistics Center, Hill AFB, Utah. Propellant Lab. Section.
QUALIFICATION OF A NEW MAPO SOURCE AND ERL-510 CURING AGENT FOR MINUTEMAN STAGE 1 UF-2121 LINER
John A. Thompson Sep. 1976 17 p refs
(AD-A030361; MANCP-350(76)) Avail: NTIS HC A02/MF A01 CSCL 21/8

Thiokol Chemical Corporation/Wasatch Division used MAPO in the production of UF-2121 liner. Thiokol changed MAPO vendors and, therefore, qualification of the new source MAPO was required. Thiokol prepared specimens from the new source and also specimens from the original source which were used as the control material in the qualification testing. The specimens were transferred to Ogden ALC for testing and reporting of the data obtained. This report includes the test results for the first and second time testing of the control and special specimens at Ogden ALC. Author (GRA)

N77-18212# George Washington Univ., Washington, D.C. Dept. of Chemistry.
EXAMINATION OF CHEMICAL KINETICS DATA USED IN INDUCTION ZONE CALCULATIONS FOR THE COMBUSTION OF CORDITE

Joseph B. Levy Aug. 1976 16 p refs
(Contract DAHC04-72-A-0001; DA Proj. 1T1-61102-AH-53)
(AD-A029747; BRL-CR-310) Avail: NTIS HC A02/MF A01 CSCL 21/9

The rate constant data used by J. G. Sotter (1965) to model the induction zone of a double-base propellant are re-examined in the light of recent data. Revised constants are reported for most of the 20 reactions considered by Sotter; about five of the changes appear significant. Author (GRA)

N77-18295# Institut fuer Chemie der Treib- und Explosivstoffe, Pfinztal (West Germany).
VELOCITY MEASUREMENTS OF MICRON-SIZED PARTICLES IN A ROCKET EXHAUST
H. P. Kugler *In* Inst. Franco-Allemand de Rech. de Saint-Louis Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 447-463 (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N77-18213*# Kanner (Leo) Associates, Redwood City, Calif.
NEW CHEMICAL REAGENTS IN MYCOLOGY
K. Micka Washington NASA Feb. 1977 9 p Transl. into ENGLISH from Ceska Mykologie (Prague), v. 8, 1954 p 165-168
(Contract NASw-2790)
(NASA-TT-F-17397) Avail: NTIS HC A021/MF A01 CSCL 07C

Spot color test reactions used for the chemical determination or study of fungi are discussed. The particular reagents tested on a number of different species of edible and poisonous mushrooms were: (1) two solutions of p-diazobenzene sulfonic acid hydrochloride, (2) an ammonium ceric nitrate solution; (3) Millon's reagent, (4) a 1% phenylhydrazine solution in diluted acetic acid; (5) Schiff's reagent, (6) a 1% benzidine solution in 10% acetic acid, and (7) a 1% ninhydrin solution in n-butyl alcohol. It is concluded that the use of ninhydrin is still an unsolved problem and that benzidine is most important among the reagents tested because it provides the greatest variety of reactions. Author

N77-18214# Illinois Univ., Urbana. Materials Research Lab.
SCIENCE OF MATERIALS Progress Report, 1 Jul. 1975 - 30 Jun. 1976
Apr. 1976 140 p refs
(Contract E(11-1)-1198)
(COO-1198-1177) Avail: NTIS HC A07/MF A01

The mechanical properties, stress corrosion cracking, and fracture of metals, alloys, and transition metal compounds, were investigated. The dynamic structure of water and electrolyte solutions at high temperature and pressure was studied as well as the properties of oxides and of the magnetic properties of alloys. The electronic properties of solids and defects in crystal structure including radiation damage are discussed with emphasis on effect of dislocations and impurities on the mechanical properties of metals, diffusion processes in superionic conductors, the defect structure of quantum crystals, high pressure studies of the electronic structure of phosphors, and the magnetic structure of transition metal atoms in nonmagnetic host crystals. ERA

N77-18215# Oak Ridge National Lab., Tenn.
WORKSHOP ON TECHNICAL ASSESSMENT OF INDUSTRIAL THERMAL INSULATION MATERIALS: SUMMARY
S. Peterson, ed. Jul. 1976 28 p refs Proc. held at Oak Ridge Tenn., 24 Mar. 1976
(Contract W-7405-eng-26)
(ORNL-TM-5515) Avail: NTIS HC A03/MF A01

Presentations on the performance of available materials, economic considerations, and measurement problems were followed by discussion. A final wrap-up session concluded that the report was valuable in pointing the direction for needed effort in the area, confirmed the indicated actions needed to further industrial application of insulation, and called for future meetings to continue the dialogue between the various facets of the industry. ERA

24 COMPOSITE MATERIALS

Includes laminates.

N77-18216*# Vought Corp., Dallas, Tex.
REINFORCED CARBON CARBON (RCC) OXIDATION RESISTANT MATERIAL SAMPLES - BASELINE COATED, AND BASELINE COATED WITH TETRAETHYL ORTHOSILICATE (TEOS) IMPREGNATION Final Report
E. E. Gantz 7 Jan. 1977 67 p refs
(Contract NAS9-14476)
(NASA-CR-151185; Rept-221RPN0533) Avail: NTIS HC A04/MF A01 CSCL 11D

Reinforced carbon-carbon material specimens were machined from 19 and 33 ply flat panels which were fabricated and processed in accordance with the specifications and procedures accepted for the fabrication and processing of the leading edge structural subsystem (LESS) elements for the space shuttle orbiter. The specimens were then baseline coated and tetraethyl orthosilicate impregnated, as applicable, in accordance with the procedures and requirements of the appropriate LESS production specifications. Three heater bars were ATJ graphite silicon carbide coated with the Vought 'pack cementation' coating process, and three were stackpole grade 2020 graphite silicon carbide coated with the chemical vapor deposition process utilized by Vought in coating the LESS shell development program entry heater elements. Nondestructive test results are reported. Author

DATA SUMMARY: No numeric data are presented.

N77-18217# Lockheed Missiles and Space Co., Palo Alto, Calif.
ANALYSIS OF SHRINKAGE STRESSES IN FIBER COMPOSITES OF REGULAR STRUCTURE
G. Kh. Murzakhanov and V. A. Tikhonov [1976] 7 p refs Transl. into ENGLISH from Mekhan. Polimerov (USSR), no. 3, 1976 p 409-415
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The kinetics of residual stress formation were studied by hypoviscoelastic analogy in all heat treatment stages. It was established that chemical shrinkage of the binder yields an insignificant contribution to the residual stress as compared with thermal shrinkage. The essential influence of the composite cooling rate on magnitude of residual stress is shown. Author

DATA SUMMARY: Stresses were calculated at the interface between two components at a point on the real axis; variables include time, stress, and temperature; 5 figures include numeric data.

N77-18218*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MICROSTRUCTURAL AND WEAR PROPERTIES OF SPUTTERED CARBIDES AND SILICIDES
T. Spalvins 1977 11 p refs To be presented at the Intern. Conf. on Wear of Materials, St. Louis, 25-27 Apr. 1977
(NASA-TM-X-73536; E-8842) Avail: NTIS HC A02/MF A01 CSCL 11D

Sputtered Cr3C2, Cr3Si2, and MoSi2 wear-resistant films (0.05 to 3.5 microns thick) were deposited on metal and glass surfaces. Electron transmission, electron diffraction, and scanning electron microscopy were used to determine the microstructural appearance. Strong adherence was obtained with these sputtered films. Internal stresses and defect crystallographic growth structures of various configurations within the film have progressively more undesirable effects for film thicknesses greater than 1.5 microns. Sliding contact and rolling element bearing tests were performed with these sputtered films. Bearings sputtered with a duplex coating (0.1-micron-thick undercoating of Cr3Si2 and subsequently 0.6-micron coating of MoS2) produced marked improvement over straight MoS2 films. Author

DATA SUMMARY: Endurance lives of 440 C stainless steel, ball bearings with sputtered MoS2 films on races and cage, with and without a Cr3Si2 underlayer; variable coefficient of friction, applied load, and test time; 2 figures include numeric data.

N77-18219*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HYBRID COMPOSITES, STATE-OF-THE-ART REVIEW: ANALYSIS, DESIGN, APPLICATION AND FABRICATION
C. C. Chamis and R. F. Lark 1977 54 p refs Presented at the 18th Ann. Structural Dynamics and Materials Conf., San Diego, Calif., 21-25 Mar. 1977; cosponsored by the Am. Inst. of Aeron. and Astronautics, the Am. Soc. of Mech. Engrs., and the Soc. of Automotive Engrs.
(NASA-TM-X-73545; E-8980) Avail: NTIS HC A04/MF A01 CSCL 11D

The areas of constituents and types of hybrids, analytical methods, design methods, applications, and fabrication procedures are discussed. The review summarizes significant contributions in each area and points out areas for further research. The description of each significant contribution is supplemented with pertinent illustrations and references. Author

DATA SUMMARY: Hybrid fiber composite laminates for structural application; the variables include stress-strain diagrams, fiber volume ratio, density, modulus of elasticity, Poisson's ratio, ply thickness, laminate composition, fiber compatibility, tensile strength, fracture toughness, temperature effects, and fabrication costs; 31 figures and 9 tables.

N77-18220*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
BRAZED BORSIC/ALUMINUM STRUCTURAL PANELS
Thomas T. Bales, H. Ross Wiant (Vought Corp., Hampton, Va.), and Dick M. Royster Washington Mar. 1977 24 p refs
(NASA-TM-X-3432; L-11075) Avail: NTIS HC A02/MF A01 CSCL 11D

A fluxless brazing process has been developed that minimizes degradation of the mechanical properties of Borsic/aluminum composites. The process, which employs 718 aluminum alloy braze, is being used to fabricate full scale Borsic/aluminum-titanium honeycomb-core panels for Mach 3 flight testing on the YF-12 aircraft and ground testing in support of the Supersonic Cruise Aircraft Research (SCAR) Program. The manufacturing development and results of shear tests on full scale panels are presented. Author

DATA SUMMARY: Nondestructive evaluation of brazed Borsic/aluminum honeycomb wing panel; the variables include shear strain, loads (forces), brazing temperature, and brazing time (min); 3 figures and no tables.

N77-18221*# Pennwalt Corp., King of Prussia, Pa.
DEVELOPMENT OF A SPECIAL PURPOSE SPACECRAFT INTERIOR COATING. PHASE 2 Technical Report, 13 Nov. 1975 - 31 May 1976
E. J. Bartoszek, Alkis Christofas, and Piero Nannelli Feb. 1977 13 p refs
(Contract NAS9-14403)
(NASA-CR-151197) Avail: NTIS HC A02/MF A01 CSCL 11D

Numerous acrylic and epoxy modifiers for the fluorocarbon latex resin base were investigated. Optimum coatings were developed by modifying the fluorocarbon latex with an epoxy acrylic resin system. In addition, a number of other formulations, containing hard acrylics as modifiers, displayed attractive properties and potential for further improvements. The preferred formulations dried to touch in about one hour and were fully dried in about twenty four hours under normal room temperature and humidity conditions. In addition to physical and mechanical properties either comparable or superior to those of commercial solvent base polyurethane or polyester coatings, the preferred compositions meet the flammability and offgassing requirements specified by NASA. Author

DATA SUMMARY. Acrylic and epoxy modified fluorocarbon latex resin coatings; the variables include modifier weight percent, coalescing agent, pigment weight percent, primer type, drying temperature and time, mechanical properties, indentation hardness, abrasion resistance, adhesion, elongation, perspiration resistance, stain resistance, corrosion resistance, flammability, and offgassing properties; no figures and 3 tables.

N77-18222*# Kanner (Leo) Associates, Redwood City, Calif.
NEW TERNARY SULFIDE COMPOUNDS OF LOW VALENCE MOLYBDENUM SHOWING MOLYBDENUM-MOLYBDENUM BONDS IN THE FORM OF CHAINS OR OCTAHEDRAL CLUSTERS
R. Chevrel Washington NASA Feb. 1977 162 p refs Transl. into ENGLISH of the doctoral dissertation "Nouveaux composes sulfures ternaires du molybdene de basse valence, presentant des liaisons molybdene-molybdene sous forme de chaines ou de clusters octaedriques" Rennes Univ., France, 1974 p 1-244
(Contract NASw-2790)
(NASA-TT-F-17354) Avail: NTIS HC A08/MF A01 CSCL 11D

Ternary sulfide compounds of low valence molybdenum were synthesized at temperatures from 1000 to 1200 C forming two distinct phases. The trivalent molybdenum sulfides are magnetic semiconductors. The bivalent molybdenum compounds show promise as a new class of materials with elevated critical temperatures and fields. Author

DATA SUMMARY: Diverse data are presented; the variables include metal-metal bonds, molecular chains, magnetic properties, chemical composition, crystal lattice, electrical resistivity, phase transformation, heat treatment, trivalency, and bivalency.

N77-18223*# Scientific Translation Service, Santa Barbara, Calif.
MICROSTRUCTURAL CHANGES DURING GAS PRESSURE SINTERING OF SILICON NITRIDE
M. Mitomo, C. OShima, and M. Tsutsumi Washington NASA Feb. 1977 10 p refs Transl. into Washington from J. Ceram. Soc. (Japan), v. 84, no. 8, 1976 p 356-360
(Contract NASw-2791)
(NASA-TT-F-17376) Avail: NTIS HC A02/MF A01 CSCL 11D

The gas pressure sintering of silicon nitride with 5 percent MgO as an additive was performed under 10 atm N, at 1450 - 1900 C. Maximum density of 95 percent of theoretical value, 3.19 g/cu cm, was obtained at 1800 C. The densification was due to liquid phase sintering and divided into two processes, rearrangement and solution-precipitation. Microstructural studies of cleavages and etches revealed that the densification was mainly attributed to rearrangement at lower temperatures than 1500 C and to solution precipitation at higher temperatures. The composition of the grain boundary phase of Si3N4 sintered at 1700 C was investigated by Auger electron spectroscopy. The result suggested that the grain boundary phase in this system was CaO-MgO-SiO2. The shrinkage at 1500 C, i.e., lower temperatures than melting point of enstatite (MgSiO2, 1557 C), was attributed to CaO which extremely lowered the melting point of the grain boundary phase. Author

DATA SUMMARY: Liquid phase sintering for higher densification; the variables include pressure effects, temperature effects, porosity, fracture strength, and granular growth; 3 figures and no tables.

N77-18224# Lockheed Missiles and Space Co., Palo Alto, Calif.
ANALYSIS OF METHODS OF DETERMINING THE INTERLAYER SHEAR STRENGTH OF COMPOSITE MATERIALS
I. G. Zhigun, V. A. Iakushin, and Iu. N. Ivonin [1977] 10 p refs Transl. into ENGLISH from Mekhan. Polimerov (Riga), no. 4, 1976 p 640-648
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The range of specimen geometric parameters are discussed in which values of the interlayer shear strength determined by four out of five methods do not change. Good agreement between the values of the determined characteristics is shown. It is established that the test results obtained by the method of three point bending of short beams do not characterize their interlayer shear strength. It is also shown that the interlayer shear strength

of a glass-plastic and the shear strength of the binder are close in magnitude. Author

DATA SUMMARY: Shear strength determinations dependent on length, width, height, and diameter of specimens; variables include relative angle of twist, torsion, relative height, working zone length, relative width, diameter, span height ratio, and shear strength; 8 figures and 2 tables include numeric data.

N77-18225# Clemson Univ., S.C. Dept. of Textiles.
DEVELOPMENT OF FLAME RETARDANTS FOR POLYESTER/COTTON BLENDS Final Report
Robert H. Barker and Michael J. Drews Sep. 1976 473 p refs
(Contract NBS-4-35963)
(PB-257884/7; NBS-GCR-ETIP-76-22) Avail: NTIS HC A20/MF A01 CSCL 11E

Structural and chemical factors affecting flammability were determined and evaluated. The interaction of the fibers was studied in both the presence and absence of flame retardants. Several specific types of phosphorous and bromine-containing materials were evaluated to determine their relative retardant efficiencies. Various methods of fixing flame retardants onto polyester were also studied with particular emphasis placed on radiation grafting techniques. Several series of model flame retardant treatments were prepared and evaluated on 50/50 blend fabrics. The results of these studies were then used as the basis for designing new flame retardant systems having a potential for commercial application. GRA

DATA SUMMARY: Diverse data are presented; variables include rate of heat release, oxygen index, chimney temperature, % phosphorous, % cotton, heat of combustion, char length, exposure time, and mode of ignition.

N77-18226# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
ULTRASONIC SPECTRUM ANALYSIS FOR NDT OF LAYERED COMPOSITE MATERIALS Final Report
William R. Scott 31 Dec. 1975 41 p refs
(AD-A028856; NADC-75324-30) Avail: NTIS HC A03/MF A01 CSCL 14/2

The structural use of advanced composite materials has increased in recent years and a number of problems has arisen associated with assuring the integrity of composite structures. Because ultrasonics has emerged as an important tool for inspecting composite materials, it has become necessary to understand more about the interaction of acoustic waves with composites and what information can be obtained by monitoring this interaction. In this paper a simple model is presented which predicts the ultrasonic frequency spectra for a broad class of layered composite materials having a finite number of laminae. Experimental verification of this model is demonstrated for arrays exhibiting both periodic and aperiodic frequency spectra. The relationship between the spectra of periodic arrays having both finite and infinite numbers of layers is discussed. Important results relating to NDT which have emerged from this study include methods for predicting the results of spectrum analysis studies on layered materials and techniques for mapping small changes in the modulus and thickness of composite materials. Also discussed is the existence of forbidden frequency bands at which ultrasound cannot be transmitted through thick layered composites. Author (GRA)

DATA SUMMARY: Prediction of frequency spectra from diffusion bonded or adhesively bonded laminates with arbitrary stacking; variables include frequency, signal amplitude, velocity of sound, and transmission coefficient; 12 figures include numeric data.

N77-18227# Edgewood Arsenal, Aberdeen Proving Ground, Md.
BALLISTIC TEST MATRIX FOR KEVLAR MATERIAL Technical Report, Aug. - Dec. 1973
Russell N. Prather and LeRoy W. Metker Aug. 1976 30 p refs
(AD-A029006; EB-TR-76054) Avail: NTIS HC A03/MF A01 CSCL 19/4

The National Institute for Law Enforcement and Criminal Justice of the Law Enforcement Assistance Administration has established a program to develop an improved lightweight, inconspicuous armor for protection against the more common handgun threats. As a subtask of this program, ballistic tests were conducted for a matrix of materials, plies, and ballistics utilizing behind-the-armor deformation techniques (backface signature). The purpose of these tests was to ascertain in a limited number of experiments any data trends in the backface signature parameters as functions of the incident ballistic parameters and material characteristics. Except for the small-caliber projectiles, which tend to slip through the weave and defeat the armor, the material backface signature appears to be dependent upon changes in striking kinetic energy, material mass, and material denier. Author (GRA)

DATA SUMMARY: Penetration of various caliber bullets through different thicknesses of Kevlar backed with gelatin; variables include caliber, depth of penetration, deformation volume, striking kinetic energy, striking velocity, number of plies, lethality, correlation coefficient, root mean square; 6 figures and 7 tables include numeric data.

N77-18228# Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.
IMPACT DAMAGE MECHANISMS OF 3-D CARBON-CARBON MATERIAL Final Report, 1 Jul. - 31 Aug. 1975
Louis Rubin 23 Jul. 1976 24 p
(Contract F04701-75-C-0076)
(AD-A029166; TR-0076(6550-77)-2; SAMSO-TR-76-142) Avail: NTIS HC A02/MF A01 CSCL 16/3

Impact-induced damage mechanisms for GE 2-2-3 Carbon-Carbon have been identified for both axial and transverse fiber bundles, and changes in the nature and severity of damage have been observed as a function of location with respect to the impact crater geometry. Although axial fiber bundles exhibited column buckling failure when immediately beneath an impact crater, they were relatively intact (except for tensile cracks in some individual fibers) at positions alongside or away from the major craters. Transverse fiber bundles, however, showed column buckling failure in locations alongside or between craters, while only flexural-type failures were noted in locations directly below a crater. Author (GRA)

DATA SUMMARY: No numeric data are presented.

N77-18229# Pratt and Whitney Aircraft, East Hartford, Conn.
SOLID MECHANICS OF FLOW, FRACTURE, CREEP AND FATIGUE Final Report, 1 May 1973 - 16 Oct. 1975
T. S. Cook May 1976 13 p refs
(Contract F33615-73-C-4072; AF Proj. 7021)
(AD-A030605; PWA-5367; AFML-TR-76-48) Avail: NTIS HC A02/MF A01 CSCL 20/11

The causes and consequences of plastic flow concentration were investigated in order to gain a better understanding of the major microstructural parameters affecting plastic flow concentration in precipitation hardened materials. Micromechanical models that contribute to the understanding of deformation and fracture of high strength precipitation hardened materials were developed. These models have enabled the important, microstructural parameters to be defined and quantitatively related to the propensity for plastic flow concentration. The results of this work will enable alloy developers to concentrate on the appropriate microstructural features to minimize flow concentration. Author (GRA)

DATA SUMMARY: No numeric data are presented.

N77-18230# Naval Academy, Annapolis, Md. Energy-Environment Study Group.
DESIGN DEVELOPMENT OF ADVANCED COMPOSITE FLYWHEELS Final Report, 1 Jul. 1975 - 1 Jun. 1976
Robert A. McCoy 28 Jun. 1976 24 p refs
(AD-A030712; USNA-EPRD-28) Avail: NTIS HC A02/MF A01 CSCL 13/9

This report describes a research project to develop a highly efficient flywheel design based upon advanced filamentary composite materials. After analyzing the interrelationships between the specific energy, shape factor, strength-to-weight ratio,

configuration, stress distribution, and fiber directions, the optimal flywheel configuration selected was a rounded tapered disk. Also a fabrication technique for this flywheel model was proposed. This technique employs a simple wrapping apparatus by which unidirectional prepreg fiber/epoxy tape is wound so that the fiber directions coincide with the major stresses within the flywheel when spinning. Author-(GRA)

DATA SUMMARY: Stress plots for various flywheel designs are presented; variables include radius, half thickness, and stress; 5 figures include numeric data.

N77-18231# Army Materials and Mechanics Research Center, Watertown, Mass.
WORK-IN-PROGRESS PRESENTED AT THE ARMY SYMPOSIUM SOLID MECHANICS, 1976. COMPOSITE MATERIALS: THE INFLUENCE OF MECHANICS OF FAILURE ON DESIGN Final Report
Sep. 1976 31 p refs Symp. held at Bass River, Mass., 14-16 Sep. 1976
(AD-A029736; AMMRC-MS-76-3) Avail: NTIS HC A03/MF A01 CSCL 11/4

Contents: Large composite structures for the battlefield; Factors affecting the strength of aluminum I-beams selectively reinforced with graphite/aluminum; Transverse shear stress failure of Kevlar 49 composite and its effect on life of overwrapped pressure vessels; Variations in the failure mode of A 3-D carbon/carbon under uniaxial tensile loads; Failure criteria for composites under in-plane displacements; Behavior of angle-ply composite laminates under compression in the thickness direction; Modeling of damage and failure in notched composite laminates; Post-buckling fatigue behavior of advanced composite shear panels; Anomalous fatigue behavior of graphite-epoxy composites; Improvement of fatigue life of boron-epoxy laminates by prolonged heat under load; Effect of void content on the behavior of advanced fiber reinforced composite materials; Damage tolerance of composite sandwich structures subject to ballistic and laser impact; Failure analysis of composite cylinders subject to internal blast; Fracture control for composite laminates; On the analysis of nonhomogeneous cylindrical shells; Special finite elements for the analysis of flaw growth and fracture in fiber composites; A fundamental analysis for crack growth in a fiber reinforced composite. GRA

DATA SUMMARY: Diverse data are presented; the variables include structural composition, buckling, cracking (fracturing), fatigue (materials), crystal defects, fracture mechanics, stress-strain diagrams, laminates, filament winding, and microstructure.

N77-18232# Army Materials and Mechanics Research Center, Watertown, Mass.
PROCEEDINGS OF THE ARMY SYMPOSIUM ON SOLID MECHANICS, 1976. COMPOSITE MATERIALS: THE INFLUENCE OF MECHANICS OF FAILURE ON DESIGN Final Report
Sep. 1976 292 p refs Symp. held at Bass River, Mass., 14-16 Sep. 1976
(AD-A029735; AMMRC-MS-76-2) Avail: NTIS HC A13/MF A01 CSCL 11/4

Contents: Failure of composite plates subjected to dynamic loads; Failure behavior of filament wound cylindrical tubes; Buckling/crippling characteristics of borsic-titanium; Post-buckling behavior of graphite/epoxy laminated plates and channels; Cracking in 3-D carbon-carbon composites during processing and effects on performance; Microstructural characterization of crack propagation and analytical modeling of carbon-carbon composites; Effects of manufacturing and in-service defects on composite materials; Damage tolerant structural concepts for fiber composites; Fail-safe composite rotor hub; Effect of variability of design parameters on stress concentration estimates; Failure mechanics of fiber composite notch charpy specimens; Fatigue damage in notched composite laminates; Fracture behavior of cross-ply composite materials; Finite element analysis of mechanical and thermal edge effects in composite laminates; Relaxation of residual stresses in angle-ply composite laminates; On the three-dimensionality of failure modes in angle-ply strips under tension. GRA

DATA SUMMARY: Diverse data are presented; the variables include structural composition, buckling, cracking (fracturing), fatigue (materials), crystal defects, fracture mechanics, stress-strain diagrams, laminates, filament winding, and microstructure.

N77-18035*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TIME-TEMPERATURE-STRESS CAPABILITIES OF COMPOSITES FOR SUPERSONIC CRUISE AIRCRAFT APPLICATIONS
J. F. Haskins (General Dynamics Corp./Convair, San Diego, Calif.), J. R. Kerr (General Dynamics Corp./Convair, San Diego, Calif.), and B. A. Stein *In its* Proc. on the SCAR Conf., Pt. 2, 1976 30 p refs (For primary document see N77-18019 09-01)
(Contract NAS1-12308)
Avail: NTIS HC A23/MF A01 CSCL 11D

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also 77 *Thermodynamics and Statistical Physics.*

N77-18233 Riber, Paris (France). Dept. d'Analyse.
ION SPECTROMETER SIMS Final Report [ETUDE ET MISE AU POINT D'UN SPECTROMETRE IONIQUE SIMS]
G. Devant Jan. 1976 65 p refs Partly in FRENCH and partly in ENGLISH
(Contract DGRST-73-7-1611)
Avail: Issuing Activity

The principle and realization of a secondary ion mass spectrometer for physical and chemical analysis of the first atomic layers of solid surfaces is described. The secondary ions are obtained by bombardment of the sample surface with an ion beam with an energy between 300 and 5000 eV. The secondary emission of a sample under ion bombardment is characteristic of its surface, and a coefficient is defined which is a function of the structure, the chemical species, the surface state, and primary beam characteristics. The work described covers development of an ion gun, an insulating valve for rapid change of sample, an energy analyzer for the noise limiting filter, and adaption of an ion counting circuit. ESA

N77-18234*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TABLE AND CHARTS OF EQUILIBRIUM NORMAL-SHOCK PROPERTIES FOR HYDROGEN-HELIUM MIXTURES WITH VELOCITIES TO 70 KM/SEC. VOLUME 1: 0.95 H2-0.05 He (BY VOLUME)
Charles G. Miller, III and Sue E. Wilder Washington 1976 239 p refs Revised 4 Vol.
(NASA-SP-3085-Vol-1) Avail: NTIS HC A11/MF A01 CSCL 07D

Equilibrium thermodynamic and flow properties are presented in tabulated and graphical form for moving, standing, and reflected normal shock waves into hydrogen-helium mixtures representative of postulated outer planet atmospheres. These results are presented in four volumes and the volmetric compositions of the mixtures are 0.95H2-0.05He in Volume 1, 0.90H2-0.10He in Volume 2, 0.85H2-0.15He in Volume 3, and 0.75H2-0.25He in Volume 4. Properties include pressure, temperature, density, enthalpy, speed of sound, entropy, molecular-weight ratio, isentropic exponent, velocity, and species mole fractions. Incident (moving) shock velocities are varied from 4 to 70 km/sec for a range of initial pressure of 5 N/sq m to 100 kN/sq m. Results are applicable to shock-tube flows and for determining flow conditions behind the normal portion of the bow shock about a blunt body at high velocities in postulated outer planet atmospheres. The document is a revised version of the original edition of NASA SP-3085 published in 1974. Author

N77-18235*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TABLE CHARTS OF EQUILIBRIUM NORMAL-SHOCK PROPERTIES FOR HYDROGEN-HELIUM MIXTURES WITH VELOCITIES TO 70 KM/SEC. VOLUME 2: 0.90 H2-0.10 He (BY VOLUME)
Charles G. Miller, III and Sue E. Wilder Washington 1976 239 p refs Revised 4 Vol.
(NASA-SP-3085-Vol-2) Avail: NTIS HC A11/MF A01 CSCL 07D

For abstract, see N77-18234.

N77-18236*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TABLE AND CHARTS OF EQUILIBRIUM NORMAL-SHOCK PROPERTIES FOR HYDROGEN-HELIUM MIXTURES WITH VELOCITIES TO 70 KM/SEC. VOLUME 3: 0.85 H2-0.15 He (BY VOLUME)
Charles G. Miller, III and Sue E. Wilder Washington 1976 239 p refs Revised 4 Vol.
(NASA-SP-3085-Vol-3) Avail: NTIS HC A11/MF A01 CSCL 07D

For abstract, see N77-18234.

N77-18237*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TABLE AND CHARTS OF EQUILIBRIUM NORMAL-SHOCK PROPERTIES FOR HYDROGEN HELIUM MIXTURES WITH VELOCITIES TO 70 KM/SEC. VOLUME 4: 0.75 H2-0.25 He (BY VOLUME)
Charles G. Miller, III and Sue E. Wilder 1976 239 p refs Revised 4 Vol.
(NASA-SP-3085-Vol-4) Avail: NTIS HC A11/MF A01 CSCL 07D

For abstract, see N77-18234.

N77-18238*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DEVICE FOR THE DETECTION OF PHENOL AND RELATED COMPOUNDS Patent Application
Julian G. Schiller (Pittsburgh Univ.) and C. C. Liu, inventors (to NASA) (Pittsburgh Univ.) Filed 25 Feb. 1977 22 p
(Grant NsG-3002)
(NASA-Case-LEW-12513-1; US-Patent-Appl-SN-772167) Avail: NTIS HC A02/MF A01 CSCL 07D

A method is described which permits the selective oxidation and potentiometric detection of phenol and related compounds in an electrochemical cell. An anode coated with a gel immobilized oxidative enzyme and a cathode are each placed in an electrolyte solution. The potential of the cell is measured by a potentiometer connected to the electrodes. NASA

N77-18239*# Kanner (Leo) Associates, Redwood City, Calif.
ELECTRONIC PROPERTIES OF CARBONS
A. Marchand, P. Delhaes, A. Pecault, J. Zanchetta, and J. Uebersfeld Washington NASA Feb. 1977 79 p refs Transl. into ENGLISH from the book "Les Carbons" v. 1, chapter 10, Paris, Edit. Masson and Co., 1965 p 405-478
(Contract NASw-2790)
(NASA-TT-F-17356) Avail: NTIS HC A05/MF A01 CSCL 07D

The electronic properties of carbons which can be graphitized (brittle carbons) and those which cannot (tough carbons) are investigated. Under the effect of temperatures and increasing durations of treatment, experiments are conducted to determine (1) diamagnetic susceptibility; (2) paramagnetic susceptibility; (3) galvanomagnetic properties; (4) specific electrical resistance; and (5) thermoelectric effect. Author

N77-18240# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany).
HETEROGENEOUS COMBUSTION OF HIGHLY ALUMINIZED HYBRID FUELS
Hendrik R. Lips 29 Nov. 1976 26 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Jun. 1977
Avail: NTIS HC A03/MF A01

The results of an experimental investigation of the combustion characteristics of highly metallized hybrid fuels in a transparent burner are presented. The solid fuel grains consisted of 60 wt percent aluminized polymer binders and were combusted with liquid FLOX as oxidizer. The influence of metal type, metal content, polymerbinder type and FLOX composition on the regression rate and combustion characteristics were determined in order to aid in the selection of an optimal propellant formulation for future motor firings. Author

N77-18241# Atlantic Richfield Hanford Co., Richland, Wash. Dept. of Advanced Waste Engineering.
SODIUM NITRATE COMBUSTION LIMIT TESTS
G. A. Beitel Apr. 1976 28 p ref
(Contract E(45-1)-2130)
(ARH-LD-123) Avail: NTIS HC A03/MF A01

The tests were conducted on one-gram samples at atmospheric pressure. Below 380 C, NaNO3 was stable and did not support combustion. At moisture concentrations above 22 wt percent, exothermic reactions did not propagate in even the most energetic and reactive compositions. Fresh resin and paraffin were too volatile to enable a NaNO2-supported combustion process to propagate. Concentrations of NaNO3 above 95 wt percent or below 35 wt percent did not react with enough energy release to support combustion. Author (ERA)

N77-18242# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
HIGH TEMPERATURE UV PHOTOELECTRON SPECTROSCOPY Ph.D. Thesis
Sefik Suzer Mar. 1976 108 p refs
(Contract W-7405-eng-48)
(LBL-4922) Avail: NTIS HC A06/MF A01

A photoelectron spectrometer was modified to achieve better vacuum up to 800 C and provided with a better data handling system. Atomic vapors of Ca, Sr, Ba, Zn, Cd, and Hg were studied by HeI (or NeI) radiations, using photoelectron spectroscopy. Several satellite lines were observed and were attributed to initial state configuration interaction in the ground states of these atoms. ERA

N77-18243# California Univ., Berkeley. Dept. of Mechanical Engineering.
THE THERMAL PYROLYSIS OF METHYLAMINE Interim Report
O. I. Smith and R. F. Sawyer Jan. 1976 19 p refs Presented at Western States Sect./Combust. Inst. Meeting, Salt Lake City, spring 1976
(Grant AF-AFOSR-2299-2; AF Proj. 9750)
(AD-A029705; UCB-ME-76-72; AFOSR-76-1018TR) Avail: NTIS HC A02/MF A01 CSCL 21/4

The pyrolysis of methylamine has been studied over a temperature range of 1007-1167 K. The existence of imines as intermediates in the formation of pyrolysis products is postulated. An expression for the global pyrolysis rate over the temperature range of 1087-1132 K was obtained. Author (GRA)

N77-18244# California Univ., Berkeley. Dept. of Mechanical Engineering.
THE THERMAL OXIDATION OF METHYLAMINE Interim Report
O. I. Smith and R. F. Sawyer Jan. 1976 22 p refs Presented at Western States Sect./Combust. Inst. Meeting, Salt Lake City, spring 1976
(Grant AF-AFOSR-2299-72; AF Proj. 9750)
(AD-A029704; UCB-ME-76-3; AFOSR-76-1017TR) Avail: NTIS HC A02/MF A01 CSCL 21/4

The oxidation of methylamine was studied over the temperature range of 1320 to 1600 K in the post-flame region of a non-iso-thermal flow reactor. Combustion product analysis was performed by means of a gas chromatograph equipped with chemiluminescent detector capable of quantitatively measuring small concentrations of a wide variety of nitrogen containing species. Concentration profiles of a major nitrogen containing combustion products were obtained. An activation energy of about 53 kjoule/mole for the global oxidation and reaction order of one with respect to methylamine were extracted from this data. Author (GRA)

N77-18245# Forest Products Lab., Madison, Wis.
ROOM CORNER-WALL FIRE TESTS OF SOME STRUCTURAL SANDWICH PANELS AND COMPONENTS Final Report
Carlton A. Holmes May 1976 80 p refs Sponsored by HUD
(PB-258513/1) Avail: NTIS HC A05/MF A01 CSCL 13M

Research was conducted to establish fire performance criteria for structural sandwich assemblies used in housing. Fire performance of sandwich materials and panels in a room setting was compared, by a room cornerwall fire test, to the material performance in the 8- and 25-foot furnaces. The information obtained in the room corner-wall fire test was shown to be useful and necessary to supplement other laboratory results to more fully appraise the fire hazards of the material or assembly. GRA

N77-18246# Factory Mutual Research Corp., Norwood, Mass.
SCALING OF RADIATIVE CHARACTERISTICS OF TURBULENT DIFFUSION FLAMES
G. H. Markstein Jun. 1976 51 p refs Presented at the 16th Intern. Symp. on Combustion, Cambridge, Mass., Aug. 1976 Sponsored in part by NSF
(Grant NFPCA-76006)
(PB-259126/1; FMRC-22361-4; RC-B-66; NBS-GCR-76-80) Avail: NTIS HC A04/MF A01 CSCL 13L

The particular case of scaling the radiative properties of turbulent gaseous-fuel diffusion flames with fuel flow rate was considered.

N77-18247# California Univ., Irvine. Combustion Lab.
MECHANISMS OF EXHAUST POLLUTANTS AND PLUME FORMATION IN CONTINUOUS COMBUSTION Interim Scientific Report, 1 May 1975 - 28 Feb. 1976
G. S. Samuelsen Jun. 1976 84 p refs
(Grant AF-AFOSR-2710-74; AF Proj. 9711)
(AD-A031233; UCI-ARTR-76-10; AFOSR-76-1122TR; ISR-2) Avail: NTIS HC A05/MF A01 CSCL 21/2

An analytical and experimental study is being conducted to promote an understanding of the processes governing the emission characteristics of continuous combustion power sources and thus provide a basis for reducing adverse environmental effects and for controlling plume signatures resulting from aircraft operations. The modeling development can, in addition, be readily adapted to dump combustor and gas turbine combustion. The configuration chosen for the study is an opposed-jet laboratory combustor (OJC). Three numerical programs are used for modeling purposes. The current year has emphasized the utility and range of applicability of the numerical methods for the case of isothermal flow. Eddy viscosity models and boundary condition specification have received the greatest emphasis in a series of systematic test of prediction against experiment. The numerical methods are currently being expanded to include propane as well as methane oxidation kinetics. Evaluation of the numerical codes for the case of hot, reacting flow will be the emphasis of the continuation year. Preheat capability has been added to the experimental dimension of the study. In addition, extensive evaluation of chemical transformation of nitrogen oxides while sampling combustion products is in progress. Author (GRA)

N77-18248# ARO, Inc., Arnold Air Force Station, Tenn.
COMPARISON OF UV ABSORPTION MEASUREMENTS WITH PROBE-SAMPLING MEASUREMENTS OF NITRIC OXIDE CONCENTRATION IN A JET ENGINE COMBUSTOR EXHAUST Final Report, 1 Apr. - 1 Jul. 1975
J. D. Few, W. K. McGregor, and H. N. Glassman AEDC Sep. 1976 33 p refs
(ARO Proj. R32P-A6A)
(AD-A030005; ARO-ETF-TR-76-77; AEDC-TR-76-134) Avail: NTIS HC A03/MF A01 CSCL 14/2

Measurements were made in the exhaust of a T-56 turbine engine combustor of nitric oxide (NO) concentration using an ultraviolet (UV) spectral absorption technique. The measurements were made at two axial locations in the combustor exhaust stream. The NO gamma-band radiation at 2265 A produced in a resonance source was passed through the exhaust stream, and the amount transmitted was recorded. The mathematical model used to determine the NO concentration from the absorption measurements is described. Pressure and temperature broadening effects on the measured absorption are considered in the line-by-line transmission calculation. The line-of-sight absorption measurements through the axisymmetric exhaust stream were converted to local concentration values via an iterative radial inversion computation. These in situ measurements are compared to NO concentration values obtained by conventional probe-sampling techniques using a chemiluminescent analyzer. The in situ measurements of the NO concentration were larger than the probe-sampled measurements by from 50 to 80 percent, depending upon the measurement location in the exhaust stream. Author (GRA)

N77-18289# Karlsruhe Univ. (West Germany). Engler-Bunte-Institut.
VELOCITY MEASUREMENTS IN DIFFUSION FLAMES BY MEANS OF LASER DOPPLER ANEMOMETRY
R. Guenther and W. Roth *In* Inst. Franco-Allemand de Rech. de Saint-Louis Proc. of thie ISL/AGARD Workshop on Laser Anemometry 1976 p 299-323 refs (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

N77-18291# Technische Universitaet, Munich (West Germany).
INVESTIGATION OF SELF-EXCITED OSCILLATIONS IN COMBUSTION CHAMBERS AND DIRECT DETERMINATION OF THE PARTICLE VELOCITY USING A LASER-DOPPLER-ANEMOMETER
H. Schimmer *In* Inst. Franco-Allemand de Rech. de Saint-Louis Proc. of ISL/AGARD Workshop on Laser Anemometry 1976 p 375-384 Sponsored by Deutsche Forschungsgemeinschaft (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

N77-18292# Institut Franco-Allemand de Recherches, St. Louis (France).
INVESTIGATION OF HIGH-SPEED FLAMES BY LDV TECHNIQUES
B. Koch, H. J. Schaefer, and H. J. Pfeifer *In its* Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 385-397 ref (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

N77-18293# Sheffield Univ. (England). Dept. of Chemical Engineering and Fuel Technology.
VELOCITY OF DROPLETS IN KEROSENE SPRAY FLAMES
N. A. Chigier and A. C. Styles *In* Inst. Franco-Allemand de Rech. de Saint-Louis Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 399-416 refs Sponsored by the Atomic Energy Res. Estab., Harwell (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

N77-18294# United Technologies Research Center, East Hartford, Conn.
AIR AND FUEL DROPLET VELOCITY STUDIES IN COMBUSTION SYSTEMS
F. K. Owen *In* Inst. Franco-Allemand de Rech. de Saint-Louis Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 417-445 refs (For primary document see N77-18278 09-31)
(Contract EPA-68-02-1873)
Avail: NTIS HC A20/MF A01

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N77-18249*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
WELDABILITY OF HIGH-TOUGHNESS IRON - 12 PERCENT-NICKEL ALLOYS WITH REACTIVE METAL ADDITIONS OF TITANIUM, ALUMINUM, OR NIOBIUM
Jack H. Delvetian (Youngstown State Univ., Ohio), Joseph R. Stephens, and Walter R. Witzke. Washington Feb. 1977 23 p refs
(NASA-TN-D-8403; E-8883) Avail: NTIS HC A02/MF A01 CSCL 11F

Three exceptionally high toughness Fe-12Ni alloys designed for cryogenic service were welded by using the gas tungsten arc welding process. Evaluation of their weldability included equivalent energy fracture toughness tests, transverse weld tensile tests at -196 and 25 C, and weld crack sensitivity tests. The Fe-12Ni-0.25Ti alloy proved extremely weldable for cryogenic applications, having weld and heat affected zone properties comparable to those of the wrought base alloy. The Fe-12Ni-0.5Al alloy had good weld properties only after the weld joint was heat treated. The Fe-12Ni-0.25Nb alloy was not considered weldable for cryogenic use because of its poor weld joint properties at -196 C and its susceptibility to hot cracking. Author

DATA SUMMARY: Effects of gas tungsten arc welding on Fe-12Ni alloy sheets containing titanium, aluminum, or niobium additions; the variables include fracture toughness, weld cooling rate, heat treatment, hot rolling, yield strength, tensile strength, elongation (percent), alloy content, interstitial content, and microstructure; 8 figures and 3 tables.

N77-18250*# Martin Marietta Corp., Denver, Colo.
EFFECT OF HIGH-PRESSURE OXYGEN ON THE MECHANICAL PROPERTIES OF ALLOYS Final Report
Fred R. Schwartzberg and John A. Shepic Feb. 1977 35 p refs
(Contract NAS8-31956)
(NASA-CR-150137; MCR-77-103) Avail: NTIS HC A03/MF A01 CSCL 11F

Unnotched and notched tensile properties of stressed and unstressed specimens of wrought 316 stainless steel, Incology 903, Monel K-500, and cast specimens of Inconel 718 were examined. Environmental tests were performed in atmospheric pressure air, high pressure nitrogen, and high pressure oxygen. Results show that oxygen did not alter the tensile properties of any of the alloys studied. Author

DATA SUMMARY: Unnotched and notched tensile properties in air at atmospheric pressure and room temperature of 319L stainless steel, Incoloy 903, Monel K-500, and Inconel 718 after stressed and unstressed exposure to atmospheric pressure air, high pressure oxygen and high pressure nitrogen; variables include composition % wt., thermal process, stress level, notch tensile strength, yield strength, elongation, reduction of area, modulus of elasticity, and notch/unnotch strength ratio; 15 tables include numeric data.

N77-18251*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPTICAL PROPERTIES OF ION BEAM TEXTURED METALS
W. R. Hudson, A. J. Weigand, and M. J. Mirtich 1977 20 p refs Presented at the 6th Annual Symp. on Applied Vacuum Science and Technology, Tampa, Fla., 14-16 Feb. 1977; sponsored by the Am. Vacuum Soc.
(NASA-TM-X-73598; E-9073) Avail: NTIS HC A02/MF A01 CSCL 11F

Copper, silicon, aluminum, titanium and 316 stainless steel were textured by 1000 eV xenon ions from an 8 cm diameter electron bombardment ion source. Simultaneously sputter-deposited tantalum was used to facilitate the development of the surface microstructure. Scanning electron microscopy of the ion textured surfaces revealed two types of microstructure. Copper, silicon, and aluminum developed a cone structure with an average peak-to-peak distance ranging from 1 micron for silicon to 6 microns for aluminum. Titanium and 316 stainless steel developed a serpentine ridge structure. The average peak-to-peak distance for both of these materials was 0.5 micron. Spectral reflectance was measured using an integrating sphere and a holraum reflectometer. Total reflectance for air mass 0 and 2, solar absorptance and total emittance normalized for a 425 K black body were calculated from the reflectance measurements. Author

DATA SUMMARY: Spectral reflectance for five specimens of ion beam textured metals; variables include wavelength, reflectance, percent of total energy, air mass zero, air mass two, surface structure growth rate, height, and ion beam sputtering duration; 6 figures and 2 tables include numeric data.

N77-18252*# Kanner (Leo) Associates, Redwood City, Calif.
MASS-SPECTROMETRIC STUDY OF THE VAPORIZATION OF NICKEL AND ITS OXIDES IN VACUO AND IN RAREFIED OXYGEN
K. M. Israpilov, V. I. Tatus, L. I. Proshak, V. Ya. Kolot, and Ya. M. Fogel Washington NASA Mar. 1977 8 p refs Transl. into ENGLISH from Ukrainskiy Fiz. Zh. (USSR), v. 20, no. 7, 1975 p 1199-1201
(Contract NASw-2790)
(NASA-TT-F-17411) Avail: NTIS HC A02/MF A01 CSCL 11F

Two dimensional Ni oxides do not vaporize from an oxidized Ni surface on heating in vacuo. When a Ni strip cleaned mechanically in air is heated in vacuo to 1300 K, NiO(+) ions evolve from its surface with a decreasing evolution rate on continued heating. After a certain heating time the Ni(+) begins to evolve while the two dimensional Ni_4O_2 molecules remain adsorbed on the specimen surface. At lower temperatures and an increased oxygen pressure, Ni_3O_2 and Ni_4O_3 form on the surface. These oxides do not vaporize, either. Author

DATA SUMMARY: Vaporization of ionized nickel surface layer and nickel oxide ion ejection; the variables include vaporization rate, oxygen partial pressure, heating time, temperature effects, phase transformation, and two dimensional oxide emission; 3 figures.

N77-18253*# General Dynamics/Convair, San Diego, Calif.
EVALUATION OF MECHANICAL PROPERTY DATA ON THE 2219 ALUMINUM ALLOY AND APPLICATION OF THE DATA TO THE DESIGN OF LIQUID HYDROGEN TANKAGE Contractor Report, Jul. 1975 - Dec. 1976
W. E. Witzell Jan. 1977 89 p refs
(Contract NAS1-14048)
(NASA-CR-145140; CASD-NAS-77-008) Avail: NTIS HC A05/MF A01 CSCL 11F

The potential use of thin guage 2219 aluminum alloy for airborne liquid hydrogen tankage was examined. Existing data were processed using the Newman two parameter equation, a prediction was made for the life expectancy of a hypothetical liquid hydrogen tank, and additional experimental data were generated in an attempt to correct the deficiencies in the existing data. Author

DATA SUMMARY: Fracture strength of cryogenic aluminum alloy fuel tank structure; the variables include crack growth rate, tensile strength, fracture strength, temperature effects, stress-strain diagrams, sheet alloy thickness, cyclic stress loads, crack initiation, crack propagation, yield strength, and weld strength; 17 figures and 17 tables.

N77-18254# Royal Armament Research and Development Establishment, Fort Halstead (England).
OVERHEATING CHARACTERISTICS OF CLEAN GUN STEELS
R. J. Lake Dec. 1975 25 p refs
(RARDE-TR-13/75; BR50964) Avail: NTIS HC A02/MF A01

Current theories on overheating are discussed and related to the properties determined for basic electric arc and electroslag refined gun steels austenized and forged at high temperatures. Low sulfur (0.005%) type D gun steels were found to suffer a reduction in toughness and ductility when heat treated at temperatures above 1200 C, but can be forged at temperatures up to 1325 C without loss of mechanical properties. Higher sulfur content steels have higher overheating temperatures. No satisfactory reheat treatment process to raise the toughness of an overheated D steel has been established. Author (ESA)

DATA SUMMARY: Mechanical properties of refined steels austenitized and forged at high temperatures; the variables include steel composition, tensile strength, elongation, reduction of area, heat treatment, forging temperature, Charpy impact resistance, fracture toughness, crack growth rate, electric arc refinement, and electroslag refinement; 7 figures and 3 tables.

N77-18255# Battelle Inst., Frankfurt am Main (West Germany).
APPLICABILITY OF CONVENTIONAL JOINING TECHNIQUES TO BORON FIBER AND CARBON FIBER REINFORCED ALUMINUM [ANWENDBARKEIT BEKANNTER FUEGETECHNIKEN AUF BORFASER- UND KOHLENSTOFFASERVERSTAERKTES ALUMINIUM]
S. Janes Bonn DOKZENTBw 1976 111 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(BMVg-FBWT-76-9) Avail: NTIS HC A06/MF A01; DOKZENTBw DM 40

Reviews are presented of investigations into the application of conventional joining techniques to aluminum alloys reinforced with borsic or carbon fibers. Suitable joining techniques for both borsic-aluminum composites and carbon-aluminum composites are gluing, braze bonding, diffusion welding, spot welding, or resistance brazing. Other suitable techniques are riveting and screwing, using special rivets and screws. Fusion welding techniques can be used under certain conditions for joining borsic-aluminum composites, but they are unsuitable for carbon-aluminum composites because melting of the aluminum matrix in the presence of the carbon fibers leads to the formation of aluminum carbide, which results in destruction of the fiber composite. Author (ESA)

DATA SUMMARY: Riveting, screwing, and braze bonding of fiber reinforced aluminum alloys; the variables include temperature effects, fiber volume, fracture strength, tensile strength, melting point, elongation, alloy composition, shear strength, fracture crack initiation, adhesive strength, and metal matrix composition; 11 figures and 20 tables.

N77-18256# Bureau of Mines, College Park, Md. College Park Metallurgy Research Center.
ELECTRODEPOSITION OF TITANIUM DIBORIDE COATINGS
David Schlain, F. X. McCawley, and G. R. Smith Jul. 1976 28 p refs
(PB-257384/8; BM-RI-8146) Avail: NTIS HC A03/MF A01 CSCL 11C

A method is described for electrodepositing titanium diboride from a molten salt bath. Initially, the electrolyte is a mixture of LiBO2, NaBO2, Na2TiO3, and TiO2. The cell is operated at 900 C in a dry, inert atmosphere with consumable anodes of titanium or hot-pressed titanium diboride (TiB2) powder. A current density of 6 A/sq dm is equivalent to a plating rate of about 35 micrometers per hour (micrometer/hr). The adherence of the TiB2 deposit varies with the substrate material. It is most adherent on molybdenum and on 4130 steel that has been preplated with copper and nickel, less adherent on nickel, and still less adherent on Inconel and on 4130 steel without the preplate. Cathode and anode reactions are suggested. GRA

DATA SUMMARY: Comparison of titanium boride deposits on molybdenum, 4130 steel, without and with preplate, TiB2 anode, and Inconel; variables include deposition time, cathode current density, thickness of deposit, cathode current efficiency, plating time, and number of deposits; 3 tables include numeric data.

N77-18257# TRW, Inc., Cleveland, Ohio.
ISOTHERMAL FORGING OF Ti-6Al-4V ALLOY AS AN IMPROVED PROCESS FOR FABRICATING WEAPON COMPONENTS Final Report
W. D. Spiegelberg and F. E. Anderson Jan. 1976 118 p refs
(Contract DAAF03-73-C-0093)
(AD-A028861; TRW-ER-7665-5; RIA-R-CR-75-048) Avail: NTIS HC A06/MF A01 CSCL 19/6

A program to evaluate the isothermal forging of titanium alloys, e.g., Ti-6Al-4V, as an improved manufacturing process for the production of light weight, high strength weapon components has been conducted. The program was performed in two phases. The first phase consisted of the isothermal forging of a simulated weapon component having thin high ribs, a large volume projection, and a uniformly thin web. This effort established optimum starting material properties, preform design, lubrication practice, tooling design and forging conditions. The important aspects of lubrication and preform design were explored in detail. The results of the first phase work were incorporated into a process specification which was used as a basis for the second phase effort. The second phase consisted of the manufacture of a demonstration weapon component, the M85 Machine Gun Cover, by isothermal forging. GRA

DATA SUMMARY: Diverse data are presented; the variables include alloy compositions, mechanical properties, temperature effect, pressure effect, dwell time, time-temperature load, heat treatment, lubricant, dimensional analysis, tensile properties, and rupture strength.

N77-18258# General Motors Corp., Indianapolis, Ind. Detroit Diesel Allison Div.
EFFECT OF A PRESTRAIN-SURFACE LAYER ELIMINATION PROCESS ON LOW CYCLE FATIGUE LIFE Final Report, 20 Feb. 1975 - 20 Mar. 1976
Victor H. Thevenow 2 Mar. 1976 43 p refs
(Contract N00019-75-C-0279)
(AD-A028780; EDR-8755) Avail: NTIS HC A03/MF A01 CSCL 20/11

Low cycle fatigue specimens of Ti 6Al-4V and a martensitic stainless steel H46, were tested to determine the effect of a prestraining-surface layer elimination process on the low cycle fatigue life. Results of axial strain controlled tests conducted at ambient temperature, using a constant strain range after prestraining for specimens with and without a surface layer elimination process, showed no significant improvements over those of baseline tests for Ti 6Al-4V. However, H46 material did show an improvement as a result of a surface layer elimination process. The improvement was approximately 15% for both crack initiation and failure. The increase in life was attributed to an increase in the proportional limit which in turn decreased the amount of plastic strain. Author (GRA)

DATA SUMMARY: Tensile test results for Ti6Al-4V and H46V are presented; variables include temperature, elongation, stress, strain percent, maximum stress, and minimum stress; 5 figures and 5 tables include numeric data.

N77-18259# Illinois Univ., Urbana-Champaign.
MACHINE CASTING OF FERROUS ALLOYS Semiannual Report, 1 Oct. 1975 - 31 Mar. 1976
Robert Mehrabian, D. G. Backman, Y. V. Murty, R. J. Lauf, and S. D. E. Ramati Aug. 1976 79 p refs
(Contract DAAG46-76-C-0023; ARPA Order 2267)
(AD-A030663; AMMRC-CTR-76-24; SAR-1) Avail: NTIS HC A05/MF A01 CSCL 13/8

This is the first semi-annual report describing research conducted at the University of Illinois at Urbana-Champaign as part of a joint university-industry research program on machine casting of ferrous alloys. During the six months covered by this report work was performed on the following subjects. (1) A variety of casting systems were designed, constructed and operated. These included transparent, low and high temperature continuous slurry producers and a laboratory casting machine. (2) Work was carried out to determine the effect of cast (Rheocast) structure on homogenization heat treatment response and mechanical properties of high temperature alloys. (3) An economic analysis of the new machine casting process was initiated. GRA

DATA SUMMARY: Mechanical and physical properties of conventionally cast and rheocast alloys, heat treatment conditions, and costs of a casting operation; variables include weight percent, temperature, time, yield strength, ultimate tensile strength, percent elongation, costs, depreciation, dendrite arm spacing, average cooling rate; 7 figures and 5 tables include numeric data.

N77-18260# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
DIFFUSION BRAZING OF ALUMINUM ALLOYS Final Report, Jan. 1970 - Dec. 1974
Guinn E. Metzger Apr. 1976 82 p refs
(AF Proj. 7351)
(AD-A031004; AFML-TR-75-210) Avail: NTIS HC A05/MF A01 CSCL 13/8

The diffusion brazing of butt joints in 6061 and 7075

aluminum alloys in a vacuum atmosphere with mechanical pressure perpendicular to the joint was investigated. Filler metals included silver, gold, copper, magnesium, zinc, Al12Si and Ag28Cu in the form of foil, powder, electroplated deposits, and vapor deposits. Joints were examined by metallography, bend tests, tensile tests, and other mechanical tests. No successful filler metal for 7075 aluminum was developed. Both silver and Al12Si filler metal in foil form produced joints in 6061 aluminum with the tensile strength of the base metal in the T6 condition. The tensile elongation and bend ductility was good in both as-brazed and T6 conditions. Author (GRA)

DATA SUMMARY: Wedge, tensile, and bend test results of brazed joints; variables include filler metal form, filler metal thickness, filler metal composition, brazing temperature, brazing pressure, diffusion temperature, diffusion time, ductility, tensile strength, elongation, and deformation; 7 tables include numeric data.

N77-18261# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
COATINGS FOR ELECTRICAL CONNECTOR SHELLS Progress Report, 1 Jul. 1975 - 1 Jul. 1976
Edward J. Jankowsky 13 Aug. 1976 35 p refs (WF54593201)
(AD-A030890; NADC-76274-30) Avail: NTIS HC A03/MF A01 CSCL 13/8

Coatings for improved corrosion protection of aluminum alloy connector shells have been investigated with a view toward replacing currently employed coatings. Cyclic heating/corrosion tests as well as SO2-salt spray exposure have indicated that duplex electroless nickel-cadmium coatings protect 6061 aluminum alloy well if they are thick enough 17.8 micrometer .0007 in. Use of these coatings is recommended. Author (GRA)

DATA SUMMARY: Results of cyclic heating/corrosion tests and salt spray tests performed on suggested protective coating materials for aluminum electrical connector shells; variables include cycles to failure, coating thickness, temperature; 5 tables include numeric data.

N77-18262# Brown Univ., Providence, R. I. Div. of Engineering.
INELASTIC DEFORMATION OF METALS UNDER DYNAMIC LOADING Final Report, 1 Jul. 1973 - 30 Jun. 1976
J. Duffy and R. J. Clifton 3 Sep. 1976 8 p refs
(Grants DA-ARO(D)-31-124-73-G182; DAHC04-75-G-0174) (AD-A031083; ARO-9288.9-E) Avail: NTIS HC A02/MF A01 CSCL 20/11

Torsional split-Hopkinson bar experiments, involving jumps in strain rate from 0.0001/s to 1000/s have been carried out on four metals (1100-0 aluminum, OFHC copper, zinc, AZ30B magnesium) at temperatures ranging from -200C to 250C. In addition, the effect of annealing temperature on the strain rate sensitivity of the flow stress has been examined for OFHC copper and a tellurium-doped copper alloy, Amtel. Effects of strain rate and strain rate history observed in these experiments have been examined within the framework of a theory of thermally activated motion, multiplication and annihilation of dislocations. Wavefront and Late-time asymptotic solutions have been obtained for wave propagation in linear elastic and visco-elastic bilaminates. Plastic waves of combined stress have been analyzed using a self-consistent slip model to characterize the stress-strain behavior of polycrystalline aluminum. Solutions have been obtained for three hardening models in which slip on one slip system increases the yield stress on (1) that system only, (2) all systems equally, (3) to a greater degree on nonco-planar systems. Comparison of theory with experiment shows better agreement than when smooth yield surface constitutive models are used. Author (GRA)

DATA SUMMARY. No numeric data are presented.

N77-18263# IIT Research Inst., Chicago, Ill.
FIELD EVALUATION OF ZINC-BASED SOLDERS FOR COPPER AND COPPER ALLOYS Final Report, 1 Jun. 1975 - 25 Mar. 1976
R. E. Beal and R. C. Hill 25 Mar. 1976 52 p
(Contract DI-BM-HO-252054)
(PB-258111/4; BM-OFR-101-76; FR-2) Avail: NTIS HC A04/MF A01 CSCL 11F

A field evaluation of the Bureau of Mines zinc-based soldering system for copper and copper alloys is described. The soldering system uses a sacrificial nickel plating to promote spontaneous wetting of copper and copper alloys. Radiator capsules soldered with zinc-based solder and exposed to a simulated radiator life cycle functioned to 1,000 hours without failure while those employing the 70Pb 30Sn solder alloy normally used by radiator manufacturers failed after 250 hours. GRA

DATA SUMMARY: Tensile-peel properties of capsule soldered joints at room temperature; variables include time, load; 1 figure includes numeric data.

N77-18264# National Bureau of Standards, Washington, D.C.
HARDNESS OF HEAT TREATED ELECTROLESS NICKEL
C. E. Johnson and F. Ogburn 3 Dec. 1975 15 p refs Submitted for publication Sponsored by Rock Island Arsenal, Ill.
(PB-258909/1) Avail: NTIS HC A02/MF A01 CSCL 11F

The hardness measurements of electroless nickel-phosphorus deposits are reported for compositions of 2.8 - 12.6 wt.% phosphorus. The hardness measurements were made on asplated samples and after heat treatments covering a wide range of time and temperature. GRA

DATA SUMMARY: Characteristics of electroless nickel baths and the effect of heat treatment conditions and phosphorus content on the hardness of nickel phosphorus deposits; variables include temperature, pH, phosphorus content, hardness, duration at heat treatment; 5 figures and 7 tables include numeric data.

N77-18032*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FATIGUE OF TITANIUM ALLOYS IN A SUPERSONIC-CRUISE AIRPLANE ENVIRONMENT
L. A. Imig *In its* Proc. of the SCAR Conf., Pt. 2, 1976 18 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 11F

N77-18033*# Rockwell International Corp., Downey, Calif.
NEW ADVANCEMENTS IN TITANIUM TECHNOLOGY AND THEIR COST AND WEIGHT BENEFITS
Leonard A. Ascani and John K. Pulley *In* NASA. Langley Res. Center Proc. of the SCAR Conf., Pt. 2, 1976 26 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 11F

N77-18034*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FABRICATION AND EVALUATION OF ADVANCED TITANIUM AND COMPOSITE STRUCTURAL PANELS
Thomas T. Bales, Edward L. Hoffman, Lee Payne (Lockheed, Calif. Co., Burbank, Calif.), and Alan L. Carter (NASA Dryden Flight Research Center) *In its* Proc. of the SCAR Conf., Pt. 2, 1976 15 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 11F

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N77-18265*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A REVERSE OSMOSIS MEMBRANE OF HIGH UREA REJECTION PROPERTIES Patent Application
Catherine C. Johnson and Theodore Wydeven, inventors (to NASA) Filed 9 Jun. 1976 21 p
(NASA-Case-ARC-10980-1; US-Patent-Appl-SN-694407) Avail: NTIS HC A02/MF A01 CSCL 11D

Reverse osmosis water purification polymeric membranes with high urea and salt rejection properties are reported. An unsaturated hydrocarbon monomer plasma and nitrogen gas were utilized for polymer deposition onto a substrate, such that nitrogen was

incorporated within the polymer in a chemically combined form. NASA

DATA SUMMARY: No numeric data are presented.

N77-18266# Royal Aircraft Establishment, Farnborough (England).
CORE LOOPING OF NYLON CORDAGE
J. E. Swallow Dec. 1975 25 p refs
(RAE-TR-75136; BR50463) Avail: NTIS HC A02/MF A01

Variance analysis was applied to the numbers of nodules formed in 438 combinations of conditions, by the looping of core yarns within the braided sheath yarns, and of penetration through the sheath, of two nylon cords used for parachute rigging lines. It was shown that the cords differed in core-looping behavior and that there was a dependence of this on the sheath tension during manufacture and on the number of plates/cm aimed at, but not on the core tension. ESA

DATA SUMMARY: Core looping of nylon yarns within braided parachute cords; the variables include sheath tension, core tension, plaits/cm, time response, module formation, and variance ratio; no figures and 10 tables.

N77-18267# Royal Aircraft Establishment, Farnborough (England).
SEARING OF LIGHT-WEIGHT FABRICS BY RUNNING CORDAGE
J. E. Swallow Dec. 1975 23 p refs
(RAE-TR-75137; BR50462) Avail: NTIS HC A02/MF A01

Variance analysis was applied to the residual breaking strengths of lightweight fabrics seared in 612 combinations of treatment and external conditions. Velocities of the running cordage greater than 13.5 m/s caused increasingly severe damage, particularly at higher contact times. Silicone treatments were helpful in reducing searing of nylon fabrics if applied in sufficient quantity. Aromatic polyamide fabric did not lose strength by searing in the conditions examined. Author (ESA)

DATA SUMMARY: Residual breaking strength of nylon and aromatic polyamide fabrics considering velocities of running cordage and silicone treatments; the variables include fabric tension, cantilever loads, cord tension, velocity of cord, and silicone treatment; no figures and 12 tables.

N77-18268# Technische Universitaet, Brunswick (West Germany). Inst. fuer Flugzeugbau und Leichtbau.
LONG TERM PROPERTIES OF CARBON FIBER REINFORCED PLASTIC STRUCTURES [UNTERSUCHUNGEN ZUM LANGZEITVERHALTEN VON BAUTEILEN AUS KOHLENSTOFFASERVERSTAERKTEN KUNSTSTOFFEN]
D. Altenkirch and M. Hansen Bonn DOKZENTBw 1976 64 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(BMVg-FBWT-76-13) Avail: NTIS HC A04/MF A01; DOKZENTBw DM 30

The long-term behavior of primary carbon-fiber reinforced plastic (CRP) structures was investigated. During a 2.5 years period the creep-bending deformations due to the dead weight loading of the wing of the grounded high-performance CRP/GRP glider SB-10 were measured. Changes in the bending stiffness and in the outer contour of the wing were also determined. The measurements demonstrated a creep-bending deformation at the wing tip of about 5 cm, no change in the bending stiffness of the wing, and a small waviness (0.15 mm) of the wing contour in the region of the spar. Systematic investigations into the creep behavior of simple CRP test specimens and CRP structures were performed, in order to obtain more data on the creep behavior of the CRP material. Author (ESA)

DATA SUMMARY: Creep bending deformation of loaded glider wing; the variables include bending diagrams, creep strength, stress-strain-time relations, oscillation frequencies, wing profiles, loads (forces), and torsional stress; 24 figures and no tables.

N77-18269# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.
THE ELASTIC CONSTANTS OF A PARTICULATE-FILLED GLASSY POLYMER: COMPARISON OF EXPERIMENTAL VALUES WITH THEORETICAL PREDICTIONS Final Report
Jack C. Smith Jun. 1976 8 p refs Repr. from Polymer Eng. and Sci., v. 16, n. 6, Jun. 1976 p 394-399
(PB-257924/1) Avail: NTIS HC A01/MF A01 CSCL 11D

The theories of Kerner or Hashin and Shtrikman, the equivalent theories of Budiansky and Hill, and a generalized van der Poel type theory are presented and discussed. Data from several sources are compared with the predictions of these theories. The van der Poel theory provides the best agreement, and gives good values for volume fractions of filler up to 0.35. GRA

DATA SUMMARY: Theoretical predictions were calculated for volume of fraction filler using the highest lower bounds and the least upper bound for shear and bulk moduli; variables include volume fraction filler, relative modulus, and Poisson ratio; 4 figures and 2 tables include numeric data.

N77-18270# Army Construction Engineering Research Lab., Champaign, Ill.
FIRE/FLAMMABILITY TEST OF POLYURETHANE FOAMS AND PROTECTIVE COATINGS Final Report
Alvin Smith Jul. 1976 64 p refs
(DA Proj. 4A1-62719-AT-33)
(AD-A028386; CERL-TR-M-129) Avail: NTIS HC A04/MF A01 CSCL 13/3

Foamed plastics offer a number of advantages in Theater of Operations (TO) construction. They can be shipped to a site in low-volume, high-density forms and converted to low-density, high-volume construction materials. The low-density forms thus made possess high strength and good stability and are typically excellent thermal insulators. They can be used either as primary structural materials (foam domes) or as secondary structural materials contributing to the rigidity and load-bearing capability of wood or metal framework (panelized buildings). The greatest drawback to use foamed plastics is flammability; generally, such materials burn when subjected to fire, even with the best commercially available flame retardants incorporated. Protection of a structure (and its inhabitants) in which a foamed plastic has been used requires the development and evaluation of a protective coating to reduce flammability of the foamed plastic. The objective of this investigation was to develop a protective coating medium which will allow and encourage the use of foamed plastics in TO construction. Polyurethane foams were identified as the most probable candidates for TO construction; and because using available materials without adding new ones to the inventory stock list is desirable, a coating composed of portland cement, lime, sand, and water was developed. GRA

DATA SUMMARY: Results of compartment tests for coated and uncoated specimens are considered; variables include thermocouple location, thermocouple heights, time, and temperature; 8 figures and 5 tables include numeric data.

N77-18271# Harry Diamond Labs., Adelphi, Md.
PARTICULATE SILICONE RUBBER: AN EFFECTIVE, REMOVABLE ENCAPSULANT FOR ELECTRONIC PACKAGING
R. Richard Palmisano and Darrell W. Neily Aug. 1976 20 p refs
(DA Proj. 1X3-64307-D-212)
(AD-A031162; HDL-TR-1762) Avail: NTIS HC A02/MF A01 CSCL 13/8

A method of encapsulating electronic circuit board assemblies that enables rapid application and removal of the encapsulant was developed and evaluated. Low-density, inexpensive, foamed silicone rubber particles that are environmentally and electrically stable were used in lieu of conventional hard 'potting'. The silicone rubber particles can be easily applied by pouring and packing into electronic package voids; they are likewise easily removed from the package (and reusable), should circuit maintenance of rework be necessary. Vibration tests of typical missile-borne applications indicate that, at resonance, electronic-circuit-board assemblies protected by this method experiences less than 10 percent of the acceleration measured before encapsulation. Author (GRA)

DATA SUMMARY: Sinusoidal vibration tests of electronic

circuit-based assemblies were used to determine the effectiveness of foamed silicone-rubber particle encapsulation; variables include frequency and amplification factor; 4 figures include numeric data.

N77-18272# United Technologies Research Center, East Hartford, Conn.
DEVELOPMENT OF UNIDIRECTIONALLY SOLIDIFIED EUTECTIC CERAMIC MATRIX-METAL COMPOSITES Final Report, Mar. 1975 - Mar. 1976
Charles O. Hulse 15 Apr. 1976 65 p refs
(Contract N62269-75-C-0120)
(AD-A030977; UTRC/R76-912084-4; NADC-76284-30) Avail: NTIS HC A04/MF A01 CSCL 21/5

The objective of this work was to identify and develop directionally solidified ceramic matrix-metal eutectic composites for use uncoated at temperatures > or = 1315 C (2400 F) in aircraft gas turbines. Metal-oxygen systems were sought in which the metal whisker phase would form a self-protective oxide coating when exposed to elevated temperatures. A number of metal-oxygen combinations were examined including Ta, Ta - Ta2O5, Ti or Nb with Al2O3, Cr2O3 solid solutions, Cr and Cr - Ta with the MgO.Al2O3 spinel, Cr with the mullite-zircon eutectic composition, and Fe and Fe - Cr with the FeO.Cr2O3 spinel with and without Al2O3 replacements for some of the Cr2O3. GRA

DATA SUMMARY: Mechanical properties and chemical composition of directionally solidified ceramic metal matrix eutectic composites; variables include stress, interlamellar spacing, tensile strength, solidification speed, work to fracture, temperature, weight percent; 5 figures and 2 tables include numeric data.

N77-18273# Lehigh Univ., Bethlehem, Pa. Ceramics Research Lab.
THERMAL CONDUCTIVITY AND DIFFUSIVITY OF ENGINEERING CERAMICS Final Technical Report, Jun. 1974 - Jun. 1976
J. H. Siebeneck and D. P. H. Hasselman Aug. 1976 104 p refs
(Contract N00014-75-C-0760; NR Proj. 394-021)
(AD-A029660) Avail: NTIS HC A06/MF A01 CSCL 11/2

This report summarizes the results of a two-year research program devoted to an investigation of the effect of compositional and microstructural variables on the thermal conductivity/diffusivity and its temperature dependence of structural ceramics. A total of twelve completed studies have resulted from this program, as follows: (1) Effect of Temperature Dependence of Thermal Conductivity on Thermal Stress Resistance of Brittle Materials, In Particular Aluminum Oxide; (2) Effect of Matrix Conductivity on Radiation Heat Transfer Across Pores; (3) The Thermal Diffusivity of Al2O3-Cr2O3 Solid Solutions; (4) Effect of Micro-cracking on the Thermal Diffusivity of Fe2TiO5; (5) Role of Thermal Diffusivity in the Performance of Ceramic Oxide Cutting-Tool Materials; (6) Thermal Diffusivity of Non-Stoichiometric Titanium-Dioxide; (7) Thermal Diffusivity of Si-Al-O-N Compositions; (8) Thermal Diffusivity of Glassy Carbons; (9) Effect of Micro-cracking on the Thermal Diffusivity of Polycrystalline Aluminum-Niobate; (10) Effect of Micro-cracking on the Thermal Diffusivity of MgTi2O5; (11) Micro-cracking as a Mechanism for Improving Thermal Shock Resistance and Thermal Insulation Properties of Ceramic Materials; (12) The Effect of Microstructure and Composition on the Thermal Diffusivity of Structural Ceramics. Author (GRA)

DATA SUMMARY: Compositional and microstructural effects on thermal properties of structural ceramics; the variables include thermal diffusivity, temperature dependence, specimen thickness, structural density, crack initiation, crack propagation, glassy carbons, glassy ceramics, iron titanate, magnesium titanate, silicon nitrides, silicon aluminum oxides, alumina chromia, and silica-silicon nitrides; 23 figures and 1 table.

N77-18036*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ADVANCED SUPERSONIC TECHNOLOGY FUEL TANK SEALANTS
Robert W. Rosser and John A. Parker *In its* Proc. of the SCAR Conf., Pt. 2, 1976 15 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 11A

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N77-18274# Institut Franco-Allemand de Recherches, St. Louis (France).
SOLID COMPOSITE EXPLOSIVE WITH DETONATION VELOCITIES BETWEEN 1000 AND 9000 m/s [FESTE SPRENGSTOFFMISCHUNGEN MIT DETONATIONSGESCHWINDIGKEITEN ZWISCHEN 1000 UND 9000 m/s]
W. Kegler 29 Jun. 1976 24 p refs In GERMAN Presented at the ICT Intern. Jahrestagung 1976, Karlsruhe, West Ger., 23-25 Jun. 1976
(ISL-CO-205/76) Avail: NTIS HC A02/MF A01

The effect of certain parameters on detonation velocity was investigated for various composite explosives with a detonation velocity between 1,000 and 9,000 m/s. ESA

N77-18275# IIT Research Inst., Chicago, Ill.
INITIATION MECHANISMS OF SOLID ROCKET PROPELLANT DETONATION Interim Report, 1 Jan. 1975 - 30 Jun. 1976
A. N. Takata and A. H. Wiedermann 15 Aug. 1976 115 p refs
(Contract F44620-75-C-0059; AF Proj. 9711)
(AD-A031273; IITRI-J6352; AFOSR-76-1068TR) Avail: NTIS HC A06/MF A01 CSCL 21/9

This study involves the development of a computerized model with which to identify the causes of solid propellant rocket motor detonations during firing. The model treats the problem of suddenly exposing propellant cracks (or flaws or debonds) to chamber gases at higher pressures and temperatures than gases initially in the crack. Simplified analyses are used to compute the transient pressures produced by the gas flows, burning and crack deformations (positive and negative). These predictions are made in terms of a variety of parameters associated with the crack, chamber, motor case and propellant. Two phenomena appear important in producing pronounced pressure rises. These are: (1) partial or complete crack collapse due to stress waves reflected from the motor case and (2) rapid acceleration of the burning during the final stages of crack collapse. The latter is due to the relatively large quantities of heat acquired by the propellant during the relatively long periods of gas filling. Quantification of these effects remains to be accomplished. Author (GRA)

N77-18276# Thiokol Chemical Corp., Huntsville, Ala.
MEAN FLOW/ACOUSTIC INTERACTIONS AND STATISTICAL ANALYSIS OF STEADY STATE COMBUSTION OF NONMETALLIZED COMPOSITE SOLID PROPELLANTS Final Report, 1 May 1974 - 30 Jun. 1976
R. L. Click 30 Jun. 1976 118 p refs
(Contract F44620-74-C-0080; AF Proj. 9711)
(AD-A031006; U-76-18; AFOSR-76-1099Tr) Avail: NTIS HC A06/MF A01 CSCL 21/9

A statistical frame work capable of extending any monodisperse combustion model (steady or nonsteady) to propellants with mixed, polydisperse oxidizer was developed. The BDP model was modified to conform to the ensemble averaging requirements of the method and embedded therein. Methods to include ellipsoidal particles and additives were explored and omissions in the BDP model were corrected. An operational FORTRAN IV code is available for polydisperse, additive free AP propellants. A hydraulic analog of a T-burner was constructed and employed to explore vent flow phenomena. Results show flow downstream of vent is a Karman vortex street created by periodic flow separation/attachment on alternate sides of vent as burner flow

oscillates. Examination of Culick's one-dimensional theory has shown that vent gain prediction is a result of an improper boundary condition; proper condition yields null vent condition. A consistent method to deduce performance data from motor test data when pressure, time history is nonneutral was derived.
Author (GRA)

N77-18277# Atlantic Research Corp., Alexandria, Va. Kinetics and Combustion Group.
COMBUSTION STUDIES OF FUEL-RICH PROPELLANTS Final Report, 1 Jul. 1971 - 30 Jun. 1976
Merrill K. King Aug. 1976 156 p refs
(Contract F44620-71-C-0124; AF Proj. 9711)
(AD-A030929; TR-PL-5520; AFOSR-76-1079TR) Avail: NTIS HC A08/MF A01 CSCL 21/9

Ignition and combustion studies of boron, and highly magnesium-loaded formulations for air-agumented rocket applications are reported. Ignition and combustion characteristics of pure boron and of boron-containing particulate ejecta from highly-boron-loaded fuel-rich primary motor formulations were studied. Physical and chemical characteristics of the motor ejecta were studied and their ignition/combustion characteristics were compared to those for pure boron. The minimum surrounding temperature for ignition for the two materials was nearly identical but the ignition delay time was considerably lower for the motor ejecta material. Burning times for comparable size particles of each type were equal within experimental error. In the size range of interest (2 to 10 equal micron diameter), the burning was observed to be characterized by a d1-law (kinetics-limited combustion). Thermodynamic screening of possible highly-magnesium-loaded fuel-rich propellants was carried out and candidate castable and pressed formulations for air-augmented rocket applications were defined. Several were characterized in terms of their safety and ballistic properties. Experiments were performed to identify the characteristics of the exhaust products from combustion in the absence of air. These experiments indicated that considerable magnesium, with significant fraction of it in the gas phase is produced. The presence of such quantities of magnesium gas should result in excellent combustion of the product streams emanating from these propellants with air in a ramburner. Nozzle plugging and residue formation are possible problem areas.
GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N77-18278# Institut Franco-Allemand de Recherches, St. Louis (France).
PROCEEDINGS OF THE ISL/AGARD WORKSHOP ON LASER-ANEMOMETRY
H. J. Pfeifer and J. Haertig 1976 451 p refs Conf. proc. held at Saint-Louis, France, 5-7 May 1976 Sponsored by the German-French Res. Inst.
(R-117/76) Avail: NTIS HC A20/MF A01

The development and uses of laser velocimeters are discussed. Laser applications for the velocity measurement of particles in supersonic and transonic jet flows are described. Combustion velocity measurements are investigated with the aid of laser anemometry and new technical aspects are presented. For individual titles, see N77-18279 through N77-18301.

N77-18279# Institut Franco-Allemand de Recherches, St. Louis (France).
INTRODUCTORY LECTURE ON PARTICLE BEHAVIOUR **c34**
J. Haertig *In its* Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 1-39 refs (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

Particle movement is discussed showing mechanical behavior of microparticles in a flow, light scattering by small particles and seeding. The use of a laser Doppler velocimeter is also discussed for velocity measurement.
M.C.F.

N77-18280# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
DATA PROCESSING IN LASER ANEMOMETERY **c35**
Alain Boutier *In* Inst. Franco-Allemand de Rech. de Saint-Louis Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 41-53 refs (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

The different signal processing techniques used in laser anemometry are reviewed. The optical system which provides the signals is the fringe configuration. There are three classes of apparatus: those making a frequency analysis of the signal, those measuring the period in each burst, and the photon-correlator which calculate the auto correlation function of the signal. The processors which analyze the signal frequency are spectrum analyzers, frequency trackers and filter banks; counters measure the period in each burst and are associated to validation devices for discarding stray measurements. The means are compared and the precision of laser anemometry results is discussed. Photon-correlation is valid in case of weak light flux on the detector; frequency trackers require high particle concentration and are well fitted for hydrodynamic flows; the filter bank is not a commonly available instrument. The counting techniques seem to be suitable to process the signals in aerodynamic studies; spectrum analysis appears as a useful tool to approach the problems and a complementary instrument when the signal to noise ratio decreases.
Author

N77-18281# Naval Surface Weapons Center, White Oak, Md. Experimental Aerodynamics Branch.
LASER DOPPLER VELOCIMETRY TECHNIQUES IN TRANSONIC AND SUPERSONIC FLOWS: A REVIEW **c35**
William J. Yanta *In* Inst. Franco-Allemand de Rech. de Saint-Louis Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 55-117 refs (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

The use of laser Doppler velocimeters (LDV) in transonic and supersonic flows is presented. Problems and compromises are reviewed for the LDV and conclusions show that the LDV will become a standard measurement system in transonic and supersonic wind tunnels.
M.C.F.

N77-18282# Centre d'Etudes Aerodynamiques et Thermiques, Poitiers (France).
DEVELOPMENT AND APPLICATION OF LASER ANEMOMETRY TO TURBULENT HIGH SPEED FLOWS **c35**
P. Ardonceau, F. Boue, and R. Leblanc *In* Inst. Franco-Allemand de Rech. de Saint-Louis Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 119-165 refs (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

The development of laser anemometry in supersonic flow is discussed. The use of laser Doppler anemometers is described showing that improvement of data processing techniques must be achieved for it to become a low cost tool for aerodynamic measurement.
M.C.F.

N77-18283# United Technologies Research Center, East Hartford, Conn. Gas Dynamics Section
LV MEASUREMENTS IN A SUPERSONIC TUNNEL **c35**
J. C. Bennett, Jr. *In* Inst. Franco-Allemand de Rech. de Saint-Louis Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 167-176 (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

Preliminary measurements are made in a supersonic tunnel for flow across a weak oblique shock. Measurements are made using fringe mode optics with backscatter collection. Problems of particles following the flow accurately in supersonic flow of air with significant moisture content are discussed together with interpretation of both the cause of the problem and the solution. Final data across the shock agreed with pitot probe data to within the combined accuracy of both measuring systems.
Author

N77-18284# Imperial Coll. of Science and Technology, London (England).
THE APPLICATION OF LASER-DOPPLER ANEMOMETRY TO RECIRCULATING FLOWS **c34**
J. H. Whitelaw *In* Inst. Franco-Allemand de Rech. de Saint-Louis

Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 177-187 refs (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

Values of velocity and velocity correlations measured in and around regions of recirculating flow are discussed. The instrumentation used to obtain the measurements is described along with their advantages and disadvantages. Author

N77-18285# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
AN APPLICATION TO LASER VELOCIMETRY TO THE INTERPRETATION OF TURBULENT STRUCTURE c34
H. Doyle Thompson and Ronald D. Flack, Jr. (Va. Univ.) *In* Inst. Franco-Allemand de Rech. de Saint-Louis Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 189-231 refs (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

A mathematical model of a turbulent jet, based on a combination of locally two-dimensional eddies of various sizes and strengths, is developed as a basis for predicting laser velocimeter measurements in turbulent flows. Fundamental types of signal bias which affect the measured mean velocity and the turbulent intensity are identified. The probable magnitudes of those biases are related to the optical geometry of the LDV, the spatial and temporal distribution of seed particles, and the turbulent model parameters. Experimental measurements are used both to define the turbulent model parameters, and to determine the biases in the measured result due to changes in the optical geometry. Author

N77-18286# Sheffield Univ. (England). Dept. of Mechanical Engineering.
EXPERIMENTAL STUDY OF TURBULENCE IN PLANE SEPARATED FLOWS c34
Raymond Smyth *In* Inst. Franco-Allemand de Rech. de Saint-Louis Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 233-244 refs (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

The improvement of the pulsed hot wire anemometer and the laser Doppler anemometer have made possible such studies and this paper describes an investigation using the laser Doppler anemometer in a separated flow situation. Results are given of an experimental study of the plane turbulent separated flow of water over a double backward facing step of duct height ratio 3:1. Time mean streamwise, transverse and cross-stream components of velocity are reported, together with the turbulent velocity fluctuations. The measurements are made using a laser Doppler anemometer operating in the differential Doppler mode with forward scattering. The problem of high turbulence intensity and instantaneous flow reversals was overcome by frequency shifting of the incident laser light beams using a pair of Bragg cells. Substantial changes in flow patterns are detected together with turbulence intensities based on local streamwise velocity of up to 100% were recorded in the recirculating zones. Author

N77-18287# Boeing Co., Seattle, Wash.
APPLICATION OF LASER VELOCIMETER FOR THE EVALUATION OF THE FLOW FIELD OF A FREE MIXER DUAL FLOW NOZZLE c34
F. Klujber and C. D. Simcox *In* Inst. Franco-Allemand de Rech. de Saint-Louis Proc. of the ISL/AGARD Workshop on laser Anemometry 1976 p 245-267 (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

Laser Doppler velocimeters (LDV) have been in wide use for mapping of the flow field of single simple geometry (round) jets. However, there is little known work that explores the validity and accuracy of LDV systems in separately seeded dual flow complex mixer nozzles. The use of a confocal backscatter LDV system and its application for the mapping of the flow downstream of a free mixer nozzle is described. The LDV data is compared to conventional hot film probe measurements. The effect of seeding density differences in the two separate streams is also discussed. Author

N77-18288*# Virginia Univ., Charlottesville. Dept. of Engineering Science and Systems.
MEASUREMENTS IN THE MIXING REGION OF A TURBULENT JET IN A COFLOWING AIRSTREAM c34
J. B. Morton, G. D. Catalano, and R. R. Humphris *In* Inst. Franco-Allemend de Rech. de Saint-Louis Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 269-297 refs (For primary document see N77-18278 09-31)
(Grants NSG-47-005-019; NSF ENG-75-22488)
Avail: NTIS HC A20/MF A01 CSCL 20D

The mixing region of a turbulent jet is an important example of an intermittent turbulent shear flow. There are a great deal of interest in this region because of interest in jet noise and STOL aircraft which use upper surface blowing or externally blown flap configurations to increase lift. A detailed study of the one point statistical properties of a smoke laden jet was made using a combination of a laser velocimeter and a light scattering system. The jet, with a 14 to 1 contraction, was placed inside a wind tunnel where the ratio of the jet exit velocity to free stream was 5.1 to 1. All measurements are made for a jet Reynolds number of 22,600. Among the quantities measured are mean axial and radial velocities, axial and radial intensities, power spectra, mean smoke concentration, concentration intensities, concentration spectra, intermittencies and velocity-concentration correlations. The results are compared with hot-wire data where available. Author

N77-18289# Karlsruhe Univ. (West Germany). Engler-Bunte-Institut.
VELOCITY MEASUREMENTS IN DIFFUSION FLAMES BY MEANS OF LASER DOPPLER ANEMOMETRY c25
R. Guenther and W. Roth *In* Inst. Franco-Allemand de Rech. de Saint-Louis Proc. of thie ISL/AGARD Workshop on Laser Anemometry 1976 p 299-323 refs (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

Laser Doppler anemometry is discussed showing its advantages to give direct readings of one variable, the velocity, The optical and electronic system which was developed is described along with information on particle production. Advantages of the system to make measurements in combustion chambers and furnances are also discussed. M.C.F.

N77-18290# General Electric Co., Schenectady, N.Y.
VELOCITY MEASUREMENT OF HIGH-TEMPERATURE AND HIGH-SPEED SUBSONIC JET FLOWS USING A LASER VELOCIMETER c35
James C. F. Wang *In* Inst. Franco-Allemand de Rech. de Saint-Louis Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 325-373 refs Sponsored by the FAA (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

The flow fields of high temperature and high velocity subsonic jets are defined in connection with basic jet noise and suppressor studies. The non-contacting characteristics of the LV technique made it the most suitable system where conventional methods such as the pitot-static tube or hot wire anemometry would fail outright. Experimental results on the mean and turbulent velocity measurements of the high temperature jet flows using LV are reported. The experimental set-up, LV system and its calibration are also discussed. Author

N77-18291# Technische Universitaet, Munich (West Germany).
INVESTIGATION OF SELF-EXCITED OSCILLATIONS IN COMBUSTION CHAMBERS AND DIRECT DETERMINATION OF THE PARTICLE VELOCITY USING A LASER-DOPPLER-ANEMOMETER c25
H. Schimmer *In* Inst. Franco-Allemand de Rech. de Saint-Louis Proc. of ISL/AGARD Workshop on Laser Anemometry 1976 p 375-384 Sponsored by Deutsche Forschungsgemeinschaft (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

The mechanism of the undesired acoustic oscillations in combustion systems was investigated. It is postulated that the oscillating input of heat must be in phase with the sound pressure to produce self-sustained acoustic oscillations in the combustion chamber. If the input velocity of the reactants is periodically disturbed at the burner mouth, then the heat input of the flame will periodically be changed also, which produces pressure waves. These pressure waves are usually stored in a resonator and react at the burner. The sound pressure is a small disturbance

of the atmospheric pressure. The amplitude of the particle is usually of the same magnitude as the convective flow, if self-sustained oscillations are observed. An equation is presented for the specific impedance. I.M.

N77-18292# Institut Franco-Allemand de Recherches, St. Louis (France).
INVESTIGATION OF HIGH-SPEED FLAMES BY LDV TECHNIQUES c25
B. Koch, H. J. Schaefer, and H. J. Pfeifer *In its* Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 385-397 ref (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

Two examples for the application of a conventional one-component fringe-mode laser velocimeter in high temperature and supersonic flows are discussed: measurements in the flame of an industrial cutting torch, and preliminary measurements in the flame emerging from a combustion chamber. The study of high speed flames helps to get some knowledge about possible sources of the noise originating from jet engines. Author

N77-18293# Sheffield Univ. (England). Dept. of Chemical Engineering and Fuel Technology.
VELOCITY OF DROPLETS IN KEROSENE SPRAY FLAMES c25
N. A. Chigier and A. C. Styles *In* Inst. Franco-Allemand de Rech. de Saint-Louis Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 399-416 refs Sponsored by the Atomic Energy Res. Estab., Harwell (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

Measurements by laser anemometer and velocity in kerosene spray flames, fired vertically and burning in free air are reported. The measurement of velocity in flames provides information on flow field characteristics and acceleration of gases a consequence of thermal expansion following chemical reaction. In liquid spray flames measurement of relative velocity between droplets of varying size and local gas velocities allows the determination of local Reynolds numbers and, hence, calculation of local drag forces. Relative magnitudes of drag and momentum forces determine droplet trajectories and influence rates of vaporization. These directly affect the local mixture ratios of air and fuel and, hence, the local combustion characteristics. Author

N77-18294# United Technologies Research Center, East Hartford, Conn.
AIR AND FUEL DROPLET VELOCITY STUDIES IN COMBUSTION SYSTEMS c25
F. K. Owen *In* Inst. Franco-Allemand de Rech. de Saint-Louis Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 417-445 refs (For primary document see N77-18278 09-31) (Contract EPA-68-02-1873)
Avail: NTIS HC A20/MF A01

Laser velocimeter measurements have been made in the initial mixing region between a central swirling atomized spray of iso-octane and an annular swirling airstream in the turbulent diffusion flame burner. These flow field studies reveal a significant effect of the ambient air velocity on the droplet trajectory and large differences between the local fuel droplet and air velocities within the first two burner diameters. Two methods used to distinguish between the local droplet and gas phase velocities will be described. The first approach involves selective seeding of the annular air supply and can be used in regions of the flow where characteristic bi-modal velocity probability density functions are apparent. The alternative technique utilizes particle visibility variations to determine the local gas velocity in regions with large droplet concentrations. A new method used to determine droplet trajectories which involves droplet velocity number density measurements is also discussed. Author

N77-18295# Institut fuer Chemie der Treib- und Explosivstoffe, Pfinztal (West Germany).
VELOCITY MEASUREMENTS OF MICRON-SIZED PARTICLES IN A ROCKET EXHAUST c20
H. P. Kugler *In* Inst. Franco-Allemand de Rech. de Saint-Louis Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 447-463 (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

Experimental results of velocity measurements on a liquid fuel rocket exhaust of small performance are described. In comparison to solid rockets the burning duration of this system is of several hours with similar temperature and gas velocity characteristics. Two different methods of laser velocimetry were used and are compared. Author

N77-18296# Creare, Inc., Hanover, N.H.
SPECIAL APPLICATIONS AND NEW TECHNICAL ASPECTS OF LASER ANEMOMETRY c35
Peter W. Runstadler, Jr. *In* Inst. Franco-Allemand de Rech. de Saint-Louis Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 465-551 refs (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

A review is presented of laser velocimeter systems developed to study high speed and transient flow conditions found in axial and radial turbomachinery, helicopter rotor research, and aircraft wing vortex wake studies. Special problems found in adapting laser velocimetry to these applications, and the various techniques used to solve them, are discussed. The constraints on system designs and use of laser velocimetery in these areas is stressed. Examples of velocity flow field measurements made using these systems are presented. New technical aspects of laser velocimetry systems aimed at improving and expanding velocity measurement capability are reviewed. Author

N77-18297# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
LASER ANEMOMETRY APPLIED TO A RESEARCH COMPRESSOR c35
Alain Boutier, Guy Fertin, Robert Larguier, Jean Lefevre, and Alexandre DeSievers *In* Inst. Franco-Allemand de Rech. de Saint-Louis proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 553-565 refs (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

The wake downstream the compressor blades was studied; the velocimeter signals were chopped. The rotating wheel generated at each turn (i.e. every 20 ms) a signal which triggered, after a variable delay, a measuring gate of 10 mu sec duration; the delay could be adjusted between 0 and 1 ms, 1 ms being the time interval corresponding to the passage of two successive blades. The flow velocity was about 60 m/s. A large amount of incense smoke was injected to seed the flow; 100 values required for mean velocity calculation were obtained every 30 seconds, the glass window had to be cleaned every few minutes. The results, in good agreement with hot wire measurements, clearly show the wake, and the turbulence parameters through the wake are given in detail. Author

N77-18298# United Technologies Research Center, East Hartford, Conn. Aeroacoustics and Experimental Gas Dynamics Group.
HELICOPTER LASER VELOCIMETER (LV) MEASUREMENTS c05
J. C. Bennett, Jr. *In* Inst. Franco-Allemand de Rech. de Saint-Louis Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 567-585 refs (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

Measurements of two components of velocity were obtained in selected regions around a scale model helicopter using a laser velocimeter system. Measurements are presented for two model configurations - trim and nose down - at an equivalent full-scale air speed of 120 knots. Tests were performed using fringe mode optics with backscatter collection. A Bragg cell was used to eliminate flow direction ambiguity. Microballoons were used for seed material. The results agree with previous flow visualization tests. Considerable fuselage-rotor interaction occurred for the entire region investigated. Author

N77-18299# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
APPLICATION OF LASER ANEMOMETRY TO SHOCK TUBE STUDIES c35
H. Fima *In* Inst. Franco-Allemand de Rech. de Saint-Louis Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 587-601 (For primary document see N77-18278 09-31)

Avail: NTIS HC A20/MF A01

The velocity curve of a nonstationary flow at a given point of a shock tube, with a dynamic range extending from 1 m/s to 400 m/s was determined. The first measurements were made in back scattering mode but the signal to noise ratio was not sufficient to obtain a correct sample rate of the velocity. The same measurements were made again, using the same optical elements but in forward scattering configuration, which gave good results. Author

N77-18300# Technisch Physisch Dienst TNO-TH, Delft (Netherlands).

DEVELOPMENT OF A ROTATING GRATING AND ITS USE IN LASER VELOCIMETRY c35

J. Oldengarm, A. H. VanKrieken, and H. J. Raterink *In* Inst. Franco-Allemand de Rech. de Saint-Louis Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 603-615 refs (For primary document see N77-18278 09-31)

Avail: NTIS HC A20/MF A01

The relative merits of the rotating radial diffraction grating as the basic element in optical systems for use in laser Doppler velocimetry are discussed. High efficiency gratings have been obtained that can be exposed to focused laser beams with several watts of light power. The use of a rotating grating has some advantages over acousto-optic and electro-optic techniques that are often used to obtain optical frequency shifting. The rotating grating functions both as a beam splitter and as a frequency shifter. The grating itself is a very convenient beam splitter: the incident laser beam is diffracted into two beams of equal intensity independent of the state of polarization of the incident light; the two beams have equal optical path lengths and are insensitive to angular misalignments of the grating with respect to the incident beam. Author

N77-18301# Politecnico di Milano (Italy). Istituto di Macchine.

A SEMPLIFIED FORMULA FOR PARTICLE FREQUENCY RESPONSE IN TURBULENT GASEOUS FLOWS c34

A. Coghe and U. Ghezzi *In* Inst. Franco-Allemand de Rech. de Saint-Louis Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 617-627 refs (For primary document see N77-18278 09-31)

Avail: NTIS HC A20/MF A01

The problem of scattering particles capability to follow flow fields, in LDA measurements, can be analyzed comparing particle and flow turbulence frequency spectra. The ratio of the two energy spectra can be assumed as a measure of the correspondence between particle and flow fluctuations. Another criterion, ability to give a formula for the maximum particle frequency in turbulent flows, is derived and compared with the first one. The proposed formula could be useful in evaluating the upper frequency limit of a particle suspended in a turbulent flow, at least at first approximation. Author

N77-18302# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.

A MEASUREMENT ASSURANCE PROGRAM FOR ELECTRIC ENERGY Final Report

N. Michael Oldham Sep. 1976 27 p

(PB-258085/0; NBS-TN-930) Avail: NTIS HC A03/MF A01 CSCL 14B

The program enables a meter laboratory to evaluate the accuracy of its calibration process relative to the legal units of energy maintained by the National Bureau of Standards. GRA

N77-18303# Naval Ship Research and Development Center, Bethesda, Md. Ship Performance Dept.

POWERING PREDICTION FOR VARIOUS HYBRID SHIP CONCEPTS

Gabor Karafiath Apr. 1976 65 p refs

(ZF61412001)

(AD-A030530; SPD-675-01) Avail: NTIS HC A04/MF A01 CSCL 13/10

A computer program called TRIBRID is described which can rapidly calculate the smooth water resistances of some advanced hybrid and tribrid ship concepts that are supported by buoyant, dynamic, and aerostatic forces. These forces are produced by one or more hull-strut combinations similar to a demi SWATH in conjunction with large hydrofoils and/or air cushions. For a given displacement and shape, the size of each concept is determined and various drag components along with some interference drag are then calculated for a calm water, fixed zero trim and free to heave operating condition. Author (GRA)

N77-18304# National Bureau of Standards, Boulder, Colo. Inst. for Basic Standards.

COLLECTED EXECUTIVE SUMMARIES: STUDIES OF THE NATIONAL MEASUREMENT SYSTEM 1972-75

Raymond C. Sangster Aug. 1976 54 p

(PB-258323/5; NBSIR-75-947) Avail: NTIS HC A04/MF A01 CSCL 14B

Executive Summaries of the reports of the 1972-75 study by the NBS institute for Basic Standards of the U.S. National Measurement System, which consists of all of the activities and mechanisms which provide physical measurement data required by society, are presented. Some of the abbreviated titles of the Executive Summaries are: Final summary report; Direct measurements transactions matrices; Economic analysis; Structure and functions of measurement system; Time and frequency; Length and related dimensional measurements; Vibration and shock; Surface finish; Mass, volume and density; Force; Fluid flow; Pressure; Temperature; Humidity and moisture. GRA

N77-18305# Coast Guard Research and Development Center, Groton, Conn.

HIGH EXPANSION FOAM EXTINGUISHMENT OF MACHINERY SPACE FIRES Final Report

Robert G. Richards Dec. 1975 60 p refs

(AD-A030264; CGR/DC-35/75; USCG-D-83-76) Avail: NTIS HC A04/MF A01 CSCL 13/12

This report details the fire research conducted on board the M/V RHODE ISLAND during the period 10 December 1974 through 17 December 1974. The tests were designed to determine the effects of fill rate, preburn and free venting area on the effectiveness of high expansion foam when used to extinguish machinery space fires. Systems design and agent characteristics were varied in order to determine the optimum and minimum parameters of fire extinguishment. It was shown that high expansion foam could extinguish the fires when applied at a rate of 7 to 9 cubic feet of foam (400-465:1 expansion ratio) per minute per square foot of fire area. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N77-18306 General Electric Co., Louisville, Ky. Space Div.

MICROWAVE RADIATION INSTRUMENTATION EVALUATION STUDY Final Report

John E. Mulholland Feb. 1977 84 p

(DOC-77SDS014) Avail: GE Co., Philadelphia, Pa. HC $10.00

Several radiation survey instruments used to monitor radiation from radio frequency equipment for possible health hazard were evaluated and compared. Particular emphasis is placed upon the evaluation of these instruments as to accuracy, sensitivity, polarization and the type of field response. Author

N77-18307* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

NOTCH FILTER Patent

Glenn B. Shelton, inventor (to NASA) (Sperry Rand Corp., Huntsville, Ala.) Issued 8 Feb. 1977 5 p Filed 14 Apr. 1976 Supersedes N76-22462 (14 - 13, p 1653) Sponsored by NASA

(NASA-Case-MFS-23303-1; US-Patent-4,007,434; US-Patent-Appl-SN-676957; US-Patent-Class-333-75; US-Patent-Class-333-70R; US-Patent-Class-333-76; US-Patent-Class-333-82B) Avail: US Patent Office CSCL 09C

A notch filter for the selective attenuation of a narrow band of frequencies out of a larger band was developed. A helical resonator is connected to an input circuit and an output circuit through discrete and equal capacitors, and a resistor is connected between the input and the output circuits.
Official Gazette of the U.S. Patent Office

N77-18308*# TRW Systems Group, Redondo Beach, Calif.
DESIGN OF A DIGITAL COMPRESSION TECHNIQUE FOR SHUTTLE TELEVISION Final Report
A. Habibi and G. Fultz Sep. 1976 95 p refs
(Contract NAS9-14852)
(NASA-CR-151179; TRW-29393) Avail: NTIS HC A05/MF A01 CSCL 17B

The determination of the performance and hardware complexity of data compression algorithms applicable to color television signals, were studied to assess the feasibility of digital compression techniques for shuttle communications applications. For return link communications, it is shown that a nonadaptive two dimensional DPCM technique compresses the bandwidth of field-sequential color TV to about 13 MBPS and requires less than 60 watts of secondary power. For forward link communications, a facsimile coding technique is recommended which provides high resolution slow scan television on a 144 KBPS channel. The onboard decoder requires about 19 watts of secondary power. Author

N77-18309*# California Univ., Santa Barbara.
APPLICATIONS REVIEW FOR A SPACE PROGRAM IMAGING RADAR (SPIR)
D. S. Simonett Jul. 1976 231 p refs
(Contract NAS9-14816)
(NASA-CR-151182; GRSU-TR-1) Avail: NTIS HC A11/MF A01 CSCL 17I

The needs, applications, user support, research, and theoretical studies of imaging radar are reviewed. The applications of radar in water resources, minerals and petroleum exploration, vegetation resources, ocean radar imaging, and cartography are discussed. The advantages of space imaging radar are presented, and it is recommended that imaging radar be placed on the space shuttle. F.O.S.

N77-18310*# Emerson Electric Co., St. Louis, Mo.
RADAR PERFORMANCE IMPROVEMENT Final Report, 1 Dec. 1975 - 31 Jul. 1976
Gerald R. Little 31 Jul. 1976 82 p
(Contract NAS9-14760)
(NASA-CR-151189; Rept-2472) Avail: NTIS HC A05/MF A01 CSCL 17I

The AN/APQ-153 fire control radar modified to provide angle tracking was evaluated for improved performance. The frequency agile modifications are discussed along with the range-rate improvement modifications, and the radar to computer interface. A parametric design and comparison of noncoherent and coherent radar systems are presented. It is shown that the shuttle rendezvous range and range-rate requirements can be made by a Ku-Band noncoherent pulse radar. F.O.S.

N77-18311*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MINIMUM DISTORTION QUANTIZERS
Harry W. Jones, Jr. Washington Mar. 1977 125 p refs
(NASA-TN-D-8384; A-6714) Avail: NTIS HC A06/MF A01 CSCL 12A

The well-known algorithm of Max is used to determine the minimum distortion quantizers for normal, two-sided exponential, and specialized two-sided gamma input distributions and for mean-square, magnitude, and relative magnitude error distortion criteria. The optimum equally-spaced and unequally-spaced quantizers are found, with the resulting quantizer distortion and entropy. The quantizers, and the quantizers with entropy coding, are compared to the rate distortion bounds for mean-square and magnitude error. Author

N77-18312# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
THE INFLUENCE OF THE MECHANICAL CONSTRUCTION OF AN ANTENNA ARRAY ON THE PLACING OF RADIATING ELEMENTS AND THE EFFECT ON THE RADIATION PATTERN [DER EINFLUSS DES MECHANISCHEN AUFBAUS EINER GRUPPENANTENNE AUF DIE PLAZIERUNGSMOEGLICHKEITEN VON STRAHLERELEMENTEN UND DER EINFLUSS AUF DAS ANTENNENDIAGRAMM]
I. Groeger Oct. 1975 32 p refs In GERMAN; ENGLISH summary
(FFM-234) Avail: NTIS HC A03/MF A01

Various methods of producing thinned antenna arrays are described taking into consideration the mechanical construction of the electronically controlled radar system ELRA. Four examples are given showing the dependence of radiating element position on energy distribution over the sidelobe range. Author (ESA)

N77-18313# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
TARGET TRACKING IN AREAS WITH CORRELATED MEASUREMENT ERRORS [ZUR ZIELVERFOLGUNG IN GEBIETEN KORRELIERTER MESSFEHLER]
G. vanKeuk Mar. 1976 34 p refs In GERMAN; ENGLISH summary
(FFM-236) Avail: NTIS HC A03/MF A01

An optimal filter for automatic tracking of maneuvering targets from radar plots was developed, assuming that the position noise contains decorrelated and correlated parts. Results are discussed. The degradation of the tracking performance through correlation effects is demonstrated. Author (ESA)

N77-18314# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
SUPPRESSION OF RADAR CLUTTER WITH UNKNOWN SPECTRUM USING DISCRETE FOURIER TRANSFORMATION [UNTERDRUECKUNG VON RADARSTOERUNGEN MIT UNBEKANNTEM SPEKTRUM NACH DER DISKRETEN FOURIERTRANSFORMATION]
R. Klemm Feb. 1976 23 p refs In GERMAN; ENGLISH summary
(FFM-238) Avail: NTIS HC A02/MF A01

The possibility of first subjecting clutter echo signals to the Discrete Fourier Transform (DFT), and then to suppress the clutter portions adaptively in the frequency domain, was investigated. This means that the usual succession of clutter suppression and coherent integration is exchanged. Several clutter models were examined for step scan radars. Some data are obtained from clutter measured for surveillance radar. ESA

N77-18315# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
AN ADAPTIVE FILTER FOR SUPPRESSION OF RADAR CLUTTER WITH UNKNOWN SPECTRUM [EIN ADAPTIVES FILTER ZUR UNTERDRUECKUNG VON RADARSTOERUNGEN MIT UNBEKANNTEM SPEKTRUM]
W. Buehring and R. Klemm Jan. 1976 19 p refs In GERMAN; EGNLISH summary
(FFM-239) Avail: NTIS HC A02/MF A01

An adaptive nonrecessive filter for suppression of ground clutter with unknown spectra, e.g., weather clutter, chaff, and sea clutter is described. These types of clutter show a Doppler shift depending on wind direction, wind shear, and radar azimuth. The filter coefficients are calculated from the estimated clutter correlation. An experimental setup was used to study problems of realization and application. ESA

N77-18316# Marconi Co. Ltd., Chelmsford (England). Mathematical Physics and Circuitry Group.
MODSIM SIMULATION OF NON-LINEAR AMPLIFICATION OF A NARROW-BAND SIGNAL IN THE PRESENCE OF WIDE-BAND SIGNALS
J. T. B. Musson Apr. 1976 39 p
(Contract ESTEC-2327/74-HP)
(ESA-CR(P)-879) Avail: NTIS HC A03/MF A01

A method for simulating a narrow band signal as it passes through a nonlinear amplifier in combination with a signal of much wider bandwidth is described. The method assumes a repetitive waveform for the wide band signal and evaluates the distortion of the narrow band signal over many repetition periods of the wide band signal. Analytic treatment of noise is not included. Author (ESA)

N77-18317# Marconi Co. Ltd., Chelmsford (England). Mathematical Physics and Circuitry Group.
PERFORMANCE ANALYSIS OF CODE DIVISION MULTIPLE ACCESS SYSTEMS WITH SPREAD SPECTRUM PHASE MODULATION USING MODSIM
J. K. Potts, S. Shepherd, and B. G. West Jun. 1976 18 p refs
(Contract ESTEC-2327/74-HP)
(ESA-CR(P)-880) Avail: NTIS HC A02/MF A01

The use of the MODSIM computerized simulation program for treatment of a spread spectrum multiple access system is outlined and illustrated by an example. In the multi-access system known as code division multiplexing by spread spectrum, the message to be transmitted has its spectrum spread by multiplication with a pseudorandom sequence of 2-phase psk sign reversals (chips). Calculation of the performance of a system, in which different users use different pseudorandom sequences, is carried out by using the concept of coding gain. The difficulty is to take proper account of the nonlinearity in the satellite repeater. The calculation was performed using MODSIM including the QSNA routine. ESA

N77-18318# Marconi Co. Ltd., Chelmsford (England). Mathematical Physics and Circuitry Group.
PERFORMANCE ANALYSIS OF VITERBI DECODING OF CONVOLUTIONAL CODED DATA TRANSMITTED OVER A NON-LINEAR CHANNEL USING MODSIM. VOLUME 1: THEORY AND TEST CASES
J. K. Potts, S. Shepherd, and C. R. Telfer Jun. 1976 83 p refs 2 Vol.
(Contract ESTEC-2327/74-HP)
(ESA-CR(P)-881-Vol-1) Avail: NTIS HC A05/MF A01

A method is described for computing the upper bound of the event and bit error probabilities for convolutional coded data in the presence of correlated or signal dependent noise. Preference probabilities for error paths are computed by a quasi Monte Carlo technique known as importance sampling and extrapolated for longer paths. The required upper bounds are computed as sums of preference probabilities weighted by the corresponding numbers of error paths or the error counts on them. Examples are given for hard and soft decision decoding metrics. Author (ESA)

N77-18319# Marconi Co. Ltd., Chelmsford (England). Mathematical Physics and Circuitry Group.
STUDY OF SPREAD SPECTRUM AND CONVOLUTIONAL CODE TECHNIQUES. VOLUME 2: SOFTWARE DESCRIPTIONS
S. Shepherd, C. R. Telfer, and B. G. West Apr. 1976 161 p refs 2 Vol.
(Contract ESTEC-2327/74-HP)
(ESA-CR(P)-881-Vol-2) Avail: NTIS HC A08/MF A01

User manuals and software descriptions are presented for three computer programs, which analyze the performance of data transmission systems using convolutional codes. The functions of the programs are as follows: program A 1 calculates certain parameters of the state diagram, given the generators of a particular convolutional code program T 6 takes as input certain state-diagram parameters and enumerates the paths traced between states by a Viterbi decoder, after divergence from the correct path; program REAL calculates an upper bound on error probabilities for Viterbi decoding of convolutionally-encoded data, after passage through a noisy distorting channel. ESA

N77-18320# Marconi Co. Ltd., Chelmsford (England). Mathematical Physics and Circuitry Group.
PERFORMANCE ANALYSIS OF PSK SIGNALS THROUGH FADING CHANNELS
P. G. Wright Jun. 1976 84 p ref
(Contract ESTEC-2327/74-HP)
(ESA-CR(P)-882) Avail: NTIS HC A05/MF A01

The passage of PSK signals through fading channels, in the presence of noise, was analyzed, both when the channel has a flat frequency response (i.e. constant across the frequency band), and a non-flat one. Analytic expressions for the error rate were derived in cases where the receiver includes carrier phase correction, and where it does not. It is assumed the rate of fading is small compared with the bit rate, so that phase correction is feasible. In the case of non-flat fading, an adaptive equalizer was also analyzed. A simple computer program is given to evaluate the error rate for a phase-tracked flat fade, and a method is given by which a non-flat fade can be reduced to an equivalent flat fade, under certain circumstances. Author (ESA)

N77-18321# Centre National d'Etudes Spatiales, Toulouse (France).
BANDWIDTH REDUCTION OF DIGITAL TELECOMMUNICATION CHANNELS [REDUCTION DE BANDE PASSANTE DES CANAUX DE TELECOMMUNICATIONS NUMERIQUES]
Jean Cazemajou, Norbert Lannelongue, and Andre Ribes Sep. 1976 43 p In FRENCH; ENGLISH summary
(CNES-NT-45) Avail: NTIS HC A03/MF A01

The possibility of bandwidth reduction in the case of high speed digital signal transmission under white Gaussian noise constraints was investigated. It is shown that the application of Dirac shape pulse transmission and detection principles to signaling with finite amplitude and duration pulses through a band limited channel is possible. Computation of the bit error rate shows that degradation is less important than in the case of coherent detection. Author (ESA)

N77-18322# Centre National d'Etudes Spatiales, Toulouse (France).
POWER DENSITY SPECTRUM CALCULATION OF RANDOM SIGNALS. APPLICATION TO TELEMETRY SIGNALS [METHODE DE CALCUL DES SPECTRES DE DENSITE DE PUISSANCE DES SIGNAUX ALEATOIRES. APPLICATION AUX SIGNAUX DE TELEMESURES]
Jean Cazemajou Nov. 1976 51 p refs In FRENCH; ENGLISH summary
(CNES-NT-56) Avail: NTIS HC A04/MF A01

Methods are presented for calculating the power density spectrum of random signals composed of M-ary digital sequences directly and by using the correlation function as an intermediary. An application is given, for both cases, to the creation of lines in a PCM message. These methods are general and applicable to all random signals. A third method specific to PCM signals is discussed, and an application is described. ESA

N77-18323# Dacom, Inc., Santa Clara, Calif.
VIDEO IMAGE BANDWIDTH REDUCTION/COMPRESSION Final Report
J. Kriefeldt, B. Ball, and G. Tisue 24 Jun. 1976 125 p refs
(Contract F33657-75-C-0354)
(AD-A029979; DI-S-3591) Avail: NTIS HC A06/MF A01 CSCL 20/6

The effects on slant range at target detection of various techniques of transmission bandwidth reduction was examined by building parametrically variable hardware and using test subjects on real time processed GFE film input. Frame rates down to 1 fps and foveal spots, both moveable and stationary, with areas from 15% to 55% of the total display area were tested. Both one- and two- dimensional SAED (an analog/digital algorithm) compression techniques were tested. Effects of bit error rates of 0, 0.01 and 0.001 were tested. Ninety-four pilots and air traffic controllers were used as test subjects. Primary goal was a system configuration with acceptable degradation below 450 kbps. It was concluded that acceptable target detection could be achieved at a 250 kbps transmission rate (including synchronization) in the presence of 0.001 net error rate and probably down to 0.01 error rate. Author (GRA)

N77-18324# CNR, Inc., Newton, Mass.
TROPOSCATTER INTERLEAVER Final Report, Feb. 1974 - Mar. 1976
David Chase, P. A. Bello, L. J. Weng, R. Spencer, and A. Joffee Jul. 1976 222 p
(Contract F30602-74-C-0133; AF Proj. 478T)
(AD-A030054; RADC-TR-76-213) Avail: NTIS HC A10/MF A01

An interleaved Golay code and a new adaptive multiple rate coding approach were implemented and tested over a troposcatter simulator and actual tropo link. The application of error correction coding for troposcatter communications demonstrated that significant savings in transmitter power (or equivalently, reductions

in error rate) can be achieved by a coded system for decoding delays in the range of 50 milliseconds to 1/2 second. In addition, the feasibility of applying an optimum maximum likelihood (Viterbi) algorithm for digital communications in a troposcatter multipath environment was demonstrated. Author (GRA)

N77-18325# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
SPEECH UNDERSTANDING SYSTEMS Quarterly Technical Progress Report, 1 May - 31 Jul. 1976
William A. Woods, L. Bates, G. Brown, C. Cook, and B. Bruce Aug. 1976 26 p refs
(Contract N00014-75-C-0533; ARPA Order 2904)
(AD-A029368; BBN-3359; QTPR-7) Avail: NTIS HC A05/MF A01 CSCL 17/2

This report describes recent progress of the BBN Speech Understanding Systems project covering the period from May 1976 to July 1976. The BBN Speech Understanding project is an effort to develop a continuous speech understanding system which uses syntactic, semantic and pragmatic support from higher level linguistic knowledge sources to compensate for the inherent acoustic indeterminacies in continuous spoken utterances. These knowledge sources are integrated with sophisticated signal processing and acoustic-phonetic analysis of the input signal, to produce a total system for understanding continuous speech. The system contains components for signal analysis; acoustic parameter extraction; acoustic-phonetic analysis of the signal; phonological expansion of the lexicon; lexical matching and retrieval; syntactic, semantic, and pragmatic analysis and prediction; and inferential fact retrieval and question answering, as well as synthesized text or spoken output. Author (GRA)

N77-18326# Rome Air Development Center, Griffiss AFB, N.Y.
VHF/UHF ANTENNA-TO-ANTENNA COUPLING TEST REPORT Progress Report, 1 Jun. - 1 Oct. 1973
Kenneth R. Siarkiewicz and Robert L. White Jun. 1976 117 p
(AF Proj. 4540)
(AD-A029364; RADC-TR-76-180) Avail: NTIS HC A06/MF A01 CSCL 20/14

This report presents the results of coupling measurements made between pairs of commonly used communications antennas (i.e., AT-197, AS-1018, AS-1097, and AS-1181). The coupling was measured as a function of the horizontal and vertical separation distances between the antenna. The measurements were made over a frequency range of 100 MHz to 400 MHz, and the coupling is presented as a function of frequency on oscillographs. GRA

N77-18327# Williard, Pennington, Van Dyke, Inc., Casselberry, Fla.
TIME DIVISION MULTIPLEX (TDM) OVER POOR QUALITY CIRCUITS Final Technical Report, Jul. 1973 - Jul. 1975
Mervin W. Williard and J. Pennington, III Griffiss AFB, N.Y. RADC Jun. 1976 146 p refs
(Contract F30602-73-C-0358; AF Proj. 6523)
(AD-A029362; RADC-TR-76-192) Avail: NTIS HC A07/MF A01 CSCL 17/2

The objectives of this program were to study techniques, and implement hardware, which would permit the improvement of framing synchronization and maintenance of Bit Count Integrity between transmitter and receiver portions of asynchronous digital multiplexers operating in troposcatter transmission media. Existing literature was searched to obtain empirical data which was then used to calibrate a Burst Error Simulator which was designed to produce burst noise typical of existing troposcatter systems. A simplex Bit Count Integrity Frame Protection Device (BCIFPD) Transmitter and Receiver was built incorporating techniques for; continuous flywheel of framing synchronization through total signal loss; the addition of added redundancy coding to the command codes; and the correction of command code errors to restore Bit Count Integrity after deep fading. Testing of an existing asychronous multiplexer system was performed to show how it performed when burst error conditions typical of existing troposcatter transmission systems was injected between multiplexer and demultiplexer. Then the BCIFPD equipment was inserted into the test setup to show the improvement offered by that equipment. The BCIFPD equipment proved to contain much more capability than was necessary to provide good performance over typical troposcatter transmission links as defined by existing data. Author (GRA)

N77-18328# Texas Instruments, Inc., Dallas. Central Research Labs.
ACOUSTIC RIDGE WAVEGUIDE TECHNOLOGY Final Technical Report, 6 Jan. 1975 - 30 Jun. 1976
Robert S. Wagers Aug. 1976 94 p refs
(Contract N00014-75-C-0317; ARPA Order 2827)
(AD-A029510; TI-08-76-41) Avail: NTIS HC A05/MF A01 CSCL 09/1

The feasibility of etching single-crystal lithium niobate and alpha-quartz to produce wedge-shaped acoustic waveguides has been examined. The primary etchant considered was boiling hydrofluoric acid. Etch masks of sputtered chrome/gold were employed. Highly uniform small (approximately 0.001 inch high) waveguides could be produced in quartz substrates. LiNbO3 waveguide fabrication was not possible due to the high defect density in the material. Spurious mode excitation problems were examined and found to be minimal in unapodized transducers on mechanically lapped waveguides with large transverse dimensions. Smaller transverse dimensions or apodization of the transducers introduced interfering modes. Apodization of interdigitated transducers on wedge waveguides was evaluated as a means of achieving bandpass shaping. The entire coupling range was found to be controlled by the first wavelength of apodization. Thus, impulse response weighting by apodization will require control of electrode geometry to within fractions of a wavelength from the apex of the waveguide. Author (GRA)

N77-18329# Northeastern Univ., Boston, Mass. Dept. of Electrical Engineering.
MAXIMUM-LIKELIHOOD SEQUENCE ESTIMATION OF DIGITAL SIGNALS TRANSMITTED OVER TIME-DISPERSIVE CHANNELS Final Report
John G. Prokakis Aug. 1976 59 p refs
(Grant NSF GK-26329)
(PB-258501/6) Avail: NTIS HC A04/MF A01 CSCL 09D

Three aspects of maximum likelihood sequence estimation (MLSE) of binary data are treated. First, tight upper and lower bounds on the probability of error are obtained fo MLSE of binary data transmitted over a Rayleigh fading multipath channel with diversity. Second, a number of algorithm for reducing the computational complexity of MLSE are compared on the basis of their probability of error. Finally, the effects of quantization and rounding encountered in a digital implementation of MLSE, with fixed point arithmetic, are assessed for two simple channel models. GRA

N77-18330# Electronics Engineering Group (1842nd), Richards-Gebaur AFB, Mo.
DELAY LINE REQUIREMENTS FOR HOUTEM-SWINGATE LINK SCOPE COMMUNICATIONS Final Report
Kenneth H. Lewis 15 Aug. 1976 48 p
(AD-A030416; Rept-1842-EEG/EPECR-TR-77-7) Avail: NTIS HC A03/MF A01 CSCL 09/1

Communications systems delay line requirements for phasing receivers before combining for this unique quad-diversity link are examined. A tutorial discussion of differential delay is provided with emphasis on its necessity for proper diversity combining. A candidate delay line and test data are presented and analyzed with recommendations for solving existing delay line problems on this link. Author (GRA)

N77-18331# Duke Univ., Durham, N.C. Adaptive Signal Detection Lab.
RELATIONSHIPS BETWEEN DETECTION AND ESTIMATION: SCALAR AND ARRAY PROCESSING
Sang C. Lee Jun. 1976 177 p refs
(Contract N00014-75-C-0191)
(AD-A030029; TR-12) Avail: NTIS HC A09/MF A01 CSCL 09/4

In this work the interrelationship between detection and estimation both for scalar and array processing is investigated. Changing environmental conditions reflected in fluctuating noise levels and spatial and temporal uncertainties necessitate the design of flexible space-time processing techniques with good perform-

ance characteristics. This work contributes to a basis for adaptive processing, including adaptive array processing. GRA

N77-18332# Syracuse Univ., N.Y. Dept. of Electrical and Computer Engineering.
TRANSMISSION FROM A RECTANGULAR WAVEGUIDE INTO HALF SPACE THROUGH A RECTANGULAR APERTURE Interim Report
Joseph R. Mautz and Roger F. Harrington Aug. 1976 59 p refs
(Contract F19628-73-C-0047; AF Proj. 5635)
(AD-A030779; RADC-TR-76-264; SR-12) Avail: NTIS HC A04/MF A01 CSCL 20/14

A computer program is developed for the problem of transmission of electromagnetic waves from a rectangular waveguide into half space through a rectangular aperture. The aperture may cover all or part of the waveguide cross section, but the sides of the aperture are parallel to those of the waveguide cross section. The solution uses the moment method applied to the integral equation for the equivalent magnetic current in the aperture. The expansion and testing functions are triangles in the direction of current, and pulses transverse to the direction of current. Quantities computed are the equivalent magnetic current, the reflection coefficient and equivalent aperture admittance seen by the incident mode, and the radiation gain pattern. The computer program is described and listed with sample input-output data. Author (GRA)

N77-18333# Rome Air Development Center, Griffiss AFB, N.Y.
INTENSITY SCINTILLATIONS OF AN EM WAVE IN EXTREMELY STRONG TURBULENCE
Ronald L. Fante May 1976 16 p refs
(AF Proj. 2153)
(AD-A030723; RADC-TR-76-173) Avail: NTIS HC A02/MF A01 CSCL 20/14

It has been shown that if one assumes Gaussian field statistics in extremely strong turbulence, the scintillation index of an arbitrary source approaches unity. This result is independent of whether the source is coherent or incoherent, provided that the response time of the measuring apparatus is short compared with the coherence time of the source. Author (GRA)

N77-18334# Ohio State Univ., Columbus. ElectroScience Lab.
COMPARATIVE EVALUATION OF THE SUBSYSTEM AND NEAREST-NEIGHBOR CLASSIFIERS FOR RADAR AIRCRAFT IDENTIFICATION Interim Report
S. N. Srihari Jun. 1976 214 p refs
(Grant AF-AFOSR-2611-74; AF Proj. 9769)
(AD-A029549; ESL-3815-3; AFOSR-76-0931TR) Avail: NTIS HC A10/MF A01 CSCL 12/1

The purpose of this report is to investigate aspects of design and evaluation of classification algorithms for a type of pattern recognition problem. The problem is one that is encountered in the design of a radar aircraft identification system. This problem differs from the usual situation encountered in statistical pattern recognition theory. Here classes are characterized by labelled training patterns that are considered to be ideal. The test pattern is assumed to be a noisy version of one of the ideal patterns, where noise is generated by a statistical process. The situation where noise perturbation is Gaussian is considered in detail. The Bayes classifier in this case has the form of the Sebestyen classifier. Techniques for efficient computer implementation, and evaluation of the Sebestyen classifier are investigated. A relationship between the Sebestyen classifier and a nearest-neighbor classifier that utilizes the ideal patterns as its reference set is obtained. Conditions for identity of decision surfaces of the two classifiers are shown. These conditions are on the location of reference patterns in feature-space. GRA

N77-18335# Mississippi Univ., University. Dept. of Electrical Engineering.
ANALYSIS OF THE AIR FORCE WEAPONS LABORATORY'S HORIZONTALLY POLARIZED DIPOLE ELECTROMAGNETIC PULSE SIMULATOR Final Report, Mar. 1975 - Aug. 1976
Charles M. Butler, K. R. Umashankar, and Donald R. Wilton Aug. 1976 220 p
(Grant AF-AFOSR-2825-75; AF Proj. 9751)
(AD-A029546; AFOSR-76-1073TR) Avail: NTIS HC A10/MF A01 CSCL 09/3

This report presents an analysis of the operating characteristics of the Horizontally Polarized Dipole Electromagnetic Pulse Simulator located at Kirtland Air Force Base, New Mexico. The analysis and an attendant computer program resulting from this work enable operators of the HPD Simulator to compute with reasonable accuracy and efficiency the transient electromagnetic field radiated by the simulator into a specified test volume. A theory is developed for the loaded loop radiator, which is constructed from cages of loaded wires, and coupled, integro-differential equations are formulated for the unknown current on the wires of the structure. These equations are solved in the frequency domain and desired radiated fields are computed via Fourier transform techniques. GRA

N77-18336# Mississippi Univ., University. Dept. of Electrical Engineering.
STATIC ANALYSIS OF CONICAL ANTENNA OVER A GROUND PLANE Final Report
Donald R. Wilton Aug. 1976 41 p refs
(Grant AF-AFOSR-2832-75; AF Proj. 9751)
(AD-A029644; AFOSR-76-1078TR) Avail: NTIS HC A03/MF A01 CSCL 09/3

A static integral equation for the charge distribution on a cone over a conducting ground plane is developed. Numerical results are presented for the charge distribution, capacitance, and effective height of cones both with and without a topcap. GRA

N77-18337# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
VOICE COMMUNICATION BY SPEECH SYNTHESIS
Donald B. Warmuth, J. Ryland Mundie, and Gregg L. Vaughn May 1976 8 p refs Repr. from NAECON '76 Record, 1976 p 933-937 Presented at Proc. of IEEE 1976 Natl. Aerospace and Electron Conf., Dayton, Ohio, 18-20 May 1976
(AF Proj. 7233)
(AD-A031090; AMRL-TR-76-28) Avail: NTIS HC A02/MF A01 CSCL 17/2

An automatic technique was developed to produce recognizable speech from a string of phonetic characters input from a teletype. The technique is based on modeling the acoustical consequences of the various configurations of the vocal tract. The method, as presented, is a computer simulation of a proposed hardware unit that can be easily interfaced with a computer, teletype terminal or a digital data transmission facility. The simulation has proven that speech generation from digital data is feasible and viable at a bit rate below 100 bits per second. The current system takes a teletype input and, through a definitive set of algorithms executed on a PDP-11 computer, converts it to a form compatible with the input to a Digital Speech Synthesizer Model 4516. GRA

N77-18338# Culler/Harrison, Inc., Goleta, Calif.
A VARIABLE FRAME RATE NETWORK VOICE SYSTEM. SPEECH COMPRESSION RESEARCH AT CHI Quarterly Technical Report, Jun. - Aug. 1976
Michael McCammon and Glen J. Culler Sep. 1976 21 p refs
(Contract DAHC15-73-C-0252; ARPA Order 2359)
(AD-A030925; CHI-QTR-203) Avail: NTIS HC A02/MF A01 CSCL 17/2

A working computer system for transmission and receiving of speech messages over the ARPANET using variable frame rate linear predictive coding is described. This system conforms to the LPC-2 protocols. A detailed discussion is given of the known problems and pitfalls in speech transmission. A description is given of the methods used to deal with these problems. Author (GRA)

N77-18339# Lincoln Lab., Mass. Inst. of Tech., Lexington.
INFORMATION PROCESSING TECHNIQUES PROGRAM. VOLUME 1: PACKET SPEECH/ACOUSTIC CONVOLVERS Semiannual Technical Summary Report, 1 Jan. - 30 Jun. 1976
Bernard Gold and Ernest Stern 30 Jun. 1976 27 p refs
(Contract F19628-76-C-0002; ARPA Order 2006; ARPA Order 2929)

(AD-A031217; ESD-TR-76-186-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 17/2

This report describes work performed under three programs: Packet Speech, Acoustic Convolvers, and Airborne Command and Control sponsored by the Information Processing Techniques Office of the Defense Advanced Research Projects Agency during the semiannual period 1 January through 30 June 1976. GRA

N77-18340# Northwestern Univ., Evanston, Ill. Dept. of Electrical Engineering.

APPLICATION OF GRAPH THEORY TO PROBLEMS IN COMMUNICATIONS SYSTEMS AND NETWORKS Final Report

S. L. Hakimi Sep. 1976 11 p refs

(Grant AF-AFOSR-2103-71; AF Proj. 9749)

(AD-A030888; AFOSR-76-1103TR) Avail: NTIS HC A02/MF A01 CSCL 17/2

The research problems successfully considered during the past five years can be broadly classified into five areas: (1) Communication Networks; (2) Linear and Non-Linear Circuits; (3) Variable Length Codes; (4) Digital Systems and Computer Applications; and, (5) Topics in Pure and Applied Graph Theory. GRA

N77-18341# Sacramento Air Logistics Center, McClellan AFB, Calif.

AN/GRC-171 RIVET SWITCH MULTICHANNEL UHF/AM TRANSCEIVER DEMONSTRATED MEAN TIME BETWEEN FAILURE (DMTBF) Test Report, 22 Sep. 1975 - 13 Jun. 1976

Robert J. Tavares 22 Jul. 1976 75 p

(AD-A030975; Rept-76-SM/ALC-001) Avail: NTIS HC A04/MF A01 CSCL 17/2

The DMTBF test on the AN/GRC-171 was accomplished at McClellan AFB, CA during the period of 22 Sep 75 through 13 Jun 76. Testing was conducted in the Service Engineering Test Laboratory in a simulated operational environment. All test radios were controlled and operated by Automatic Test Equipment (ATE). Bench tests were conducted during testing to monitor daily radio performance and determine any failures undetected by the ATE. Author (GRA)

N77-18342# Yuma Proving Ground, Ariz.

INSTRUMENTATION DEVELOPMENT INVESTIGATION OF COMMAND AND CONTROL CONSOLE Final Report

James N. Mitchell Jun. 1976 80 p refs

(AD-A029967; USAYPG-272) Avail: NTIS HC A05/MF A01 CSCL 05/8

This investigation describes the hardware and operating system for a prototype command and control system for controlling a single aircraft, live-firing test on the U.S. Army Yuma Proving Ground Cibola and Aircraft Armament Ranges. The report also includes the results of a systems analysis which recommended the configuration of the console and general design of the operating system described. This prototype was and continues to be a primary learning vehicle for proving ground range control developments. The primary emphasis was controlling a single test on the Cibola Aircraft Armament Range. Utilization of currently available facilities, rapid implementation, low cost, adaptability to the final system and ease of use by appropriate personnel were further considerations. Aircraft Armament Project officers were interviewed to determine requirements for support of current testing. The hardware for this system was acquired using funds from this instrumentation development project. Software was developed under the above associated Methodology Improvement Investigation. GRA

N77-18343# Rochester Univ., N.Y. Dept. of Physics and Astronomy.

INTERACTION OF ELECTROMAGNETIC RADIATION WITH BULK MATTER Final Report, 1 Aug. 1973 - 31 Jul. 1976

Emil Wolf Aug. 1976 17 p refs

(Grant DAHC04-74-G-0014)

(AD-A031056; ARO-9470.39-P) Avail: NTIS HC A02/MF A01 CSCL 20/3

This report presents summaries of investigations carried out under the above grant, chiefly in the following areas: radiation from classical charge-current distributions, multipole expansions, electrodynamics in spatially dispersive media, Cerenkov and transition radiation, quantum scattering and resonance theory, radiative energy transfer in free electromagnetic fields, spectral coherence. Author (GRA)

N77-18344# Arizona Univ., Tucson. Dept. of Electrical Engineering.

AN EXPERIMENTAL STUDY OF THE NONLINEAR PROPAGATION OF AN ELECTROMAGNETIC PULSE THROUGH THE IONOSPHERE Final Report, Jun. 1974 - Jan. 1975

Jul. 1976 72 p refs

(Contract F29601-74-C-0110; DNA Proj. NWED-QAXEA091)

(AD-A031159; AFWL-TR-75-115) Avail: NTIS HC A04/MF A01 CSCL 20/14

This report is concerned with the experimental investigation of EMP propagation through the D-region of the ionosphere. High and low amplitude EMP signals can propagate into space and pose a potential threat to satellites. The Air Force Weapons Laboratory (AFWL) has developed a theory which predicts that when an EMP propagates through the D-region of the ionosphere, considerable energy can be absorbed from this pulse, thus reducing its potential threat. We have built a plasma machine in which pulse propagation in the ionosphere can be simulated. A TEM waveguide is immersed in a nitrogen plasma. We apply a pulse simulating an EMP to the input and observe the received signal at the output. A probe, which can measure the electron distribution function, allows us to monitor the electron temperature. Thus, energy absorbed from the pulse and electron temperature can be monitored. Other diagnostic systems allow many other quantities to be monitored. Author (GRA)

N77-18345# Naval Postgraduate School, Monterey, Calif.

COMPUTER PREDICTION OF TROPOSPHERIC RADIO TRANSMISSION LOSS FOR SELECTED PATHS IN THE PACIFIC NORTHWEST M.S. Thesis

Richard Michael Cassidy, Jr. Jun. 1976 118 p refs

(AD-A030088; NPS-32CA76061) Avail: NTIS HC A06/MF A01 CSCL 20/14

In order to characterize the propagation conditions along known paths at VHF and S Band frequencies, transmission loss predictions are produced by computer methods. An attempt is made to define the standard atmospheric conditions along these paths through the presentation of the statistics for normal and super-refractive propagation conditions. GRA

N77-18346# Office of Technology Assessment, Washington, D.C.

THE FEASIBILITY AND VALUE OF BROADBAND COMMUNICATIONS IN RURAL AREAS: A PRELIMINARY EVALUATION

Apr. 1976 326 p refs

(PB-258095/9; OTA-T-33) Avail: NTIS HC A15/MF A01 CSCL 17B

The needs for broadband communications in rural areas are discussed and a preliminary evaluation of how well the applications, both actual and potential, of such communications may meet these needs is presented. The major forces underlying present rural growth are identified and from this projects the likely needs of rural areas for such communications. Major constraints, technology, FCC regulations, and cost of bringing broadband communication to rural areas are discussed. Policy alternatives are given for applications of broadband telecommunications to rural areas. Possible future OTA assessment activities in the area of file communications, if requested, are discussed. GRA

N77-18347# Institute for Telecommunication Sciences, Boulder, Colo.

THE ATTENUATION OF UHF RADIO SIGNALS BY HOUSES

P. I. Wells and P. V. Tryon (NBS, Boulder, Colo.) Aug. 1976 88 p

(PB-258447/2; OTR-76-98) Avail: NTIS HC A05/MF A01 CSCL 17B

The results of a measurement program which was conducted to determine the attenuation of UHF radio signals penetrating to the inside of a typical house are presented. The feasibility of using direct satellite communication to disseminate disaster warning messages is evaluated. The measurements were made

in a manner to determine the building attenuation as a function of frequency, construction type, climate, and the elevation angle to the signal source. GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N77-18348* National Aeronautics and Space Administration, Washington, D.C.
REQUIREMENTS FOR SOLDERED ELECTRICAL CONNECTIONS
Dec. 1976 82 p
(NHB-5300.4(3A-1)) Avail: NASA Headquarters, Washington, D. C., ATTN: Code DHA-7 CSCL 09C

The NASA requirements for hand and machine soldering for reliable electrical connectors are described along with the basic considerations necessary to ensure reliable soldered connections. Design guidelines to avoid solder cracking and solder-copper separation problems are included, and the supplier's responsibility to train and certify personnel are given. Supplier documentation of those fabrication and inspection procedures to be used for NASA work, including supplier innovations and changes in technology are provided. Author

N77-18349*# Sprague Electric Co., North Adams, Mass.
DESIGN, DEVELOP, FABRICATE AND TEST WET SLUG ALL-TANTALUM CAPACITORS IN T2 CASE SIZE Final Report, 9 Feb. - 9 Aug. 1976
Robert H. Maher 10 Sep. 1976 18 p
(Contract NAS8-31790)
(NASA-CR-150018) Avail: NTIS HC A02/MF A01 CSCL 09A

Test data and results are presented of the manufacturing and testing of seven hundred fifty (750) all tantalum capacitors of the T2 case size. L.S.

N77-18350*# Martin Marietta Corp., Denver, Colo.
ANALYTICAL STUDY OF ELECTRICAL DISCONNECT SYSTEM FOR USE ON MANNED AND UNMANNED MISSIONS Final Report
Arthur A. Rosener, Joseph A. Lenda, Richard O. Trummer, and Thomas G. Jonkoniec Jan. 1977 122 p
(Contract NAS8-31971)
(NASA-CR-150189; MCR-77-2) Avail: NTIS HC A06/MF A01 CSCL 09A

The program to survey existing electrical connector availability, and establish an optimum connector design for maintainable spacecraft substation interfaces is reported. Functional and operational requirements are given along with the results of the documentation survey, which disclosed that the MSFC series connectors have the preferred features of current connector technology. Optimum design concepts for EVA tasks, modules serviced by manipulators, and for manipulators independent of other servicing units are presented. It is concluded that separate connector designs are required for spacecraft replaceable modules, and for crewman EVA. F.O.S.

N77-18351# Ames Lab., Iowa.
ELECTRICAL SWITCHING IN BULK SAMPLES OF 0.15As-0.12Ge-0.73Te GLASS Ph.D. Thesis
David E. Eckels Jun. 1976 105 p refs
(Contract W-7405-eng-82)
(IS-T-724) Avail: NTIS HC A06/MF A01

Switching in bulk samples of 0.15As-0.12Ge-0.73Te glass is caused predominantly by the thermal switching mechanism for near treshold applied voltages. Switching also occurred by the thermal mechanism even for applied voltages an order of magnitude above the threshold voltage of the sample. A constant voltage pulse was applied to the sample and the delay time and the electrical energy input to the sample during the delay time measured. A log-log plot of the energy input to the sample during a delay time of 1.00 s as a function of the electrode spacing on the sample's surface had a slope of approximately 1.6. For theoretical study of the thermal switching mechanism, a one-dimensional calculation of the heat balance equation with radial heat flow was made and the results of the calculation followed the same trends as the experimental data. ERA

N77-18352# Air Products and Chemicals, Inc., Allentown, Pa.
ASSESSMENT AND STUDY OF EXISTING CONCEPTS AND METHODS OF CRYOGENIC REFRIGERATION FOR SUPERCONDUCTING TRANSMISSION CABLES Final Report
F. J. Kadi and R. C. Longsworth Feb. 1976 223 p refs
(Contract E(11-1)-2552)
(COO-2552-6) Avail: NTIS HC A10/MF A01

A review of current programs to develop superconducting power transmission shows that current plans require helium refrigerators operating at 5 to 13 K and 3 to 15 atm pressure with compressor power input in the range of 1,300 to 3,500 HP. Large helium refrigerators and standard nitrogen plants were studied. An average outage frequency of about 18 per year is found to be typical for both. Cost and reliability studies of alternate refrigeration systems based on studies of components show that the best current system having a failure rate of once in 20 years consists of two full size oil flooded screw compressors in parallel, manifolded to two full size cold boxes and a liquid helium back up dewar. Costs are projected as being only slightly greater than preliminary estimates. ERA

N77-18353# Brookhaven National Lab., Upton, N.Y.
DESIGN OF DOUBLE HELIX CONDUCTORS FOR SUPERCONDUCTING ac POWER TRANSMISSION
M. Garber, J. F. Bussiere, and G. H. Morgan 1976 12 p refs Presented at the Joint Intern. Magnetics and Magnetism and Magnetic Mater. Intermag Conf., Pittsburgh, 15 Jun. 1976 Sponsored by ERDA
(BNL-21338; Conf-760619-1) Avail: NTIS HC A02/MF A01

Coaxial cable conductors in the form of helical tape windings were proposed in order to make Nb3Sn cables which have flexibility and the ability to take up thermal contraction. For ac power transmission the axial magnetic fields which occur in a simple helical construction produce a number of undesirable consequences. These problems are avoided by using double layer windings of opposite helicity, with 45 deg as the optimum helix angle. However, smaller values than this are desirable for mechanical reasons, and the theory includes pitch angles less than 45 deg. Measurements on short cable models are shown to be in reasonable agreement with calculation. ERA

N77-18354# Danish Research Center for Applied Electronics, Hoersholm.
MICROWAVE INTEGRATED CIRCUIT PROCESS INVESTIGATION. WORK PACKAGE 2: HERMETIC SEALING Final Report
Poul Villien 18 Oct. 1976 14 p
(Contract ESTEC-2338/74-AK)
(ESA-CR(P)-819-Vol-4) Avail: NTIS HC A02/MF A01

Microwave integrated circuit (MIC) boxes previously showing unacceptable leak rates after environmental tests were selected for additional testing to see whether the degraded leak rates are in fact due to the connectors or to a genuine degradation in the epoxy sealing. It is shown that unacceptable large initial leak rates are due to cracks in the internal sealings of the SMA connectors. Hermetically sealed MIC boxes with acceptable small leak rates can be obtained using indium or epoxy as sealing material if the boxes are fitted with SMA connectors without internal leaks. ESA

N77-18355# Centre National d'Etudes Spatiales, Toulouse (France).
THEORETICAL DETERMINATION OF WEIGHT AND EFFICIENCY OF A dc/dc CONVERTER [CALCUL THEORIQUE DU POIDS ET DU RENDEMENT D'UN CONVERTISSEUR dc/dc]
Alphonse Barnaba Oct. 1976 56 p refs In FRENCH; ENGLISH summary
(CNES-NT-52) Avail: NTIS HC A04/MF A01

The characterstics of a dc/dc converter at different stages of a spacecraft project were surveyed in order to offset the constraints of a strict schedule. In particular, the weight and efficiency of these converters were determined theoretically, enabling the user's specifications and technological limits to be taken into account. ESA

N77-18356# United Technologies Research Center, East Hartford, Conn.

SURFACE ACOUSTIC WAVE FOURIER TRANSFORM MODULE Final Technical Report

T. M. Reeder and T. W. Grudkowski Jul. 1976 68 p refs

(Contract N00123-76-C-0392)

(AD-A030374; UTRC/R76-922276-1) Avail: NTIS HC A04/MF A01 CSCL 09/5

The application of high speed surface acoustic wave, nonlinear delay line devices to real time computation of parallel input-serial output Discrete Fourier Transforms was studied. A laboratory model DFT module using a 32 input Two-Dimensional Diode-Convolver was designed, fabricated, evaluated, and delivered. Transforms of arbitrary 32 point signals were simulated with this module with transform readout times variable from semi-infinite to as short as 1.16 microseconds. Error signals in the DFT output were shown to be no worse than -20 dB and can be significantly reduced by further development. An initial study was also carried out on a linearized product mixer using a log amplifier - dual gate FET configuration. It was shown that mixers of this type would be used to build a linear DFT module with the same high speed demonstrated in the delivered module but with input-output transfer function linear to + or - 2 dB over a 40 dB dynamic range. Author (GRA)

N77-18357# Raytheon Co., Bedford, Mass. Missile Systems Div.

RELIABILITY EVALUATION OF ECL MICROCIRCUITS Final Report, May 1974 - May 1976

E. T. Lewis, D. Bartels, and D. Capobianco Griffiss AFB, N. Y. RADC Jun. 1976 308 p

(Contract F30602-74-C-0214; AF Proj. 5519)

(AD-A029737; RADC-TR-76-193) Avail: NTIS HC A14/MF A01 CSCL 09/5

The objective of this study was to undertake a detailed analysis and reliability evaluation of ECL microcircuits available for use in high speed digital circuits. Special emphasis was placed on the effects of electromigration. The selected devices included SSI and MSI integration, one and two level metallization from a total of four major vendors. Metallization included aluminum with a silicon dopant, aluminum with copper and silicon dopants and pure aluminum with a titanium-tungsten barrier. Detail construction analysis and electrical characterization including thermal resistances were performed on all devices. Devices which failed during the performance of life testing were electrically categorized and physically analyzed to establish failure modes and mechanisms. GRA

N77-18358# Purdue Univ., Lafayette, Ind. School of Materials Engineering.

THE EFFECTS OF SUBSTRATE COMPOSITION ON THICK FILM CIRCUIT RELIABILITY Quarterly Technical Report, 1 May - 31 Jul. 1976

R. W. Vest 31 Aug. 1976 26 p refs

(Contract N00019-76-C-0354)

(AD-A030424; QTR-2) Avail: NTIS HC A03/MF A01 CSCL 09/5

During this quarter studies of the rate of the dissolution of 96% Al2O3 substrates (AlSiMag 614) in the model glass (63%PbO, 25% B2O3, 12% SiO2) were conducted as a function of temperature from 750 to 1000 C. The rate limiting steps were found to be phase boundary reaction rate control at short times and diffusion through a boundary layer under natural convection at longer times. The rate equations developed from the experimental data allow the prediction of the total quantity of substrate dissolved in the resistor glass under any processing conditions. Standard processing (800 C, 10 minutes) for the model system will result in a fired resistor volume containing 17% of ingredients derived from the substrate. Studies of the distribution of substrate ingredients throughout the resistor glass and the influence of substrate constituents dissolved in the glass on electrical properties were initiated during this quarter. Certain information concerning characterization of the substrates was obtained from the supplier and plans for obtaining the additional characterization data needed were formulated.

Author (GRA)

N77-18359# Power Hybrids, Inc., Torrance, Calif.

THE 1,000 WATT PEAK PULSED POWER AMPLIFIER 960 MHz TO 1215 MHz Final Report, 15 Jun. 1973 - 15 May 1976

Aram A. Tanielian, James R. Curtis, and Wayne E. Schaub Jun. 1976 110 p

(Contract N62269-73-C-0657)

(AD-A030367; NADC-76108-20) Avail: NTIS HC A06/MF A01 CSCL 09/5

The purpose of this program was to develop a one kilowatt peak microwave power amplifier for broadband operation over the frequency range 960 MHz to 1215 MHz using a maximum of four output transistors in parallel, 250 watt peak power each. The amplifier was to be capable of high level modulation using two basic pulse shapes (square, Gaussian). The very high power required those transistor parameters and masks which critically affect microwave pulse power performance be optimized to achieve the final operation results required by the contract. Special circuitry was developed to accommodate high power broadband performance. GRA

N77-18360# McDonnell-Douglas Astronautics Co., St. Louis, Mo.

EVALUATION OF MICROCIRCUIT ACCELERATED TEST TECHNIQUES Final Technical Report, Feb. 1973 - Aug. 1975

G. M. Johnson Griffiss AFB, N. Y. RADC Jul. 1976 318 p refs

(Contract F30602-73-C-0140; AF Proj. 5519)

(AD-A029757; RADC-TR-76-218) Avail: NTIS HC A14/MF A01 CSCL 09/5

The results of an extensive life test matrix demonstrated the general validity and effectiveness of accelerated tests of microcircuits using both temperature and voltage as accelerating stresses. Over 2500 microcircuits from TTL, CMOS and linear technologies were life tested at ambient temperatures between 125C and 285C. In general, bimodal failure distributions, comprised of early (Freak) and late (main) lognormal distributions, were observed. The relationship of median life with junction temperature could be represented with an Arrehenius reaction rate model. Activation energies for the freak distribution ranged from 0.7 eV to 1.3 eV, and in certain instances a short high temperature burn-in to eliminate the freak population results in a dramatic improvement in use-temperature failure rates. Complete high temperature microcircuit life characterization and lot acceptance tests are required to identify economically screenable lots. MIL-STD-883 test methods are proposed for general application of microcircuit high temperature accelerated tests as a new tool for assuring the reliability of semiconductor production lots, and for screening out potential surface related failures. Included in the proposed methods are guidelines for assuring test effectiveness. The inherent effectiveness of accelerated tests can only be assured through careful selection of the life-test circuit configuration, and test temperatures, and the effective analysis of the resulting failure data. GRA

N77-18361# Hughes Research Labs., Malibu, Calif.

CROSSED FIELD CLOSING SWITCH DEVELOPMENT Semiannual Report, 8 Jan. - 7 Jul. 1976

Robin J. Harvey Sep. 1976 31 p refs

(Contract DAAB07-76-C-1313)

(AD-A029917; ECOM-76-1313-1) Avail: NTIS HC A03/MF A01 CSCL 09/5

The preliminary testing and the design of crossed field closing switches for use at an average power of 0.48 MW are described. This work is directed towards a full power demonstration at 40 kV, 20 kA (10 microsec pulse width) operating at 125 Hz and an average current of 24 A. The key feature of the crossed field closing switch as opposed to other spark gap switches is the randomization of the arc location on a shot-to-shot basis. This desired randomization is observed at the intermediate test levels thus far attempted with an uncooled device. A fully cooled

device has been designed and is under construction.
Author (GRA)

N77-18362# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
PHOTOLITHOGRAPHIC TECHNIQUES FOR SURFACE ACOUSTIC WAVE (SAW) DEVICES Quarterly Report, 30 Apr. - 30 Jul. 1976
A. R. Janus, R. L. Kolb, and L. Dyal Jul. 1976 22 p
(Contract DAAB07-75-C-0044)
(AD-A030206; FR-76-19-760; QR-4) Avail: NTIS HC A02/MF A01 CSCL 09/5

The object of the program is the establishment of a production capability for surface acoustic wave devices of varied design and material for the purpose of meeting estimated military needs for a period of two years after the completion of the contract and to establish a base and plans which may be used to meet expanded requirements. The primary requirement is the pilot line production of devices that are reliable, reproducible, and low cost. The second phase of this program was completed with the delivery of ten each of the 2nd Engineering Samples comprised of bandpass, tapped delay line and pulse compression filters. Fabrication is currently underway in order to meet the requirements of 3rd, Confirmatory Phase of the program. GRA

N77-18363# Honeywell, Inc., St. Petersburg, Fla. Aerospace Div.
PROCESSING STANDARDS FOR HYBRID MICROCIRCUITS, PART 1 Final Report, 1 Jun. 1975 - 31 May 1976
Rudolph G. Oswald and William R. Rodrigues DeMiranda Sep. 1976 115 p refs
(Contract DAAB07-75-C-1367; DA Proj. 1S7-62705-AH-94)
(AD-A030421; ECOM-75-1367-F-Pt-1) Avail: NTIS HC A06/MF A01 CSCL 09/5

An in-depth study of hybrid microelectronics process controls and screens has been performed. In particular, the feasibility of substituting process controls for costly post assembly screens has been examined. The Hybrid Microelectronics Process and Quality Control Guide, a handbook in loose leaf form, is the end result of this investigation. The book consists of a reference sheet for each process, part, and material used in hybrid microelectronics with emphasis on qualification testing, process controls, and screens. This guide also contains information on critical parameters, critical previous and subsequent processes, potential problems, tooling required, and inspection criteria.
Author (GRA)

N77-18364# Honeywell, Inc., St. Petersburg, Fla. Aerospace Div.
HYBRID MICROELECTRONICS PROCESS AND QUALITY CONTROL GUIDE Final Report
William R. Rodrigues DeMiranda, Rudolph G. Oswald, and James M. Montante Ft. Monmouth, N. J. ECOM Jul. 1976 117 p
(Contract DAAB07-75-C-1367)
(AD-A030422; ECOM-75-1367-F-Pt-2) Avail: NTIS HC A06/MF A01 CSCL 09/5

This book has been written for the following purposes: (1) To identify critical processes and establish process controls and quality control data, which, if properly implemented may serve to replace some of the screens which are routinely performed after the hybrid assembly process, (2) To aid military procurement agencies to evaluate prospective hybrid vendors, (3) To aid hybrid vendors to evaluate their own processes, (4) To aid new vendors in establishing proper process controls and quality criteria, and (5) To serve as a general information and reference source. It should be noted that this book is a guide and not a specification. The information contained in it is recommended only, even though such words as 'mandatory' are used. In no case is it intended that the data listed be used as requirements to be imposed on a prospective vendor. GRA

N77-18365# Naval Postgraduate School, Monterey, Calif.
THEORETICAL ANALYSIS OF A MODEL FOR A FIELD Ph.D. Thesis
Ram Sharon Jun. 1976 81 p refs
(AD-A030080) Avail: NTIS HC A05/MF A01 CSCL 09/1

A frequency dependent analysis of a shielded edge-guided mode isolator is presented. A Fourier transform technique is applied to the boundary expressions of a structure built on a dielectric substrate, and the resulting equations are solved for the wavelength ratio. By using perturbation analysis and the results obtained for the dielectric case, solutions for the normalized propagation constant and attenuation for waves traveling in the -Z and +Z directions, in a structure built on a ferrite substrate, are obtained. GRA

N77-18366# Watkins-Johnson Co., Palo Alto, Calif.
SWITCHING EBS DEVELOPMENT PROGRAM Final Report, 11 May 1973 - 12 Jun. 1975
16 Jan. 1976 62 p
(Contract N00039-73-C-0669)
(AD-A029461) Avail: NTIS HC A04/MF A01 CSCL 09/1

Four types of switching EBS's were developed. The first was a series-connected high voltage switching EBS designed to modulate the grid of TWTs. This device demonstrated up to 1,000 V output with a risetime of 18 ns. The second device developed was a single diode high voltage switching EBS with up to 700 V peak output. The single diode design was capable of high output currents and correspondingly fast risetimes; at 700 V output a risetime of 7 ns was measured. The third tube designed and tested for the program was a dual-output 400 V switching EBS which could simultaneously modulate parallel TWTs with no coupling between the two TWTs. The fourth tube designed for the program was an improved version of the dual output-TWT. The size, cost, and weight of the device were significantly reduced while the overall performance of the device was improved. GRA

N77-18367# Spectra Mat, Watsonville, Calif.
HIGH CURRENT DENSITY CATHODE INVESTIGATIONS Semifinal Report, 1 Jul. 1975 - 1 Jan. 1976
L. J. Cronin and R. Reaves Jul. 1976 25 p
(Contract DAAB07-75-C-1353)
(AD-A030104; ECOM-75-1353-1) Avail: NTIS HC A02/MF A01 CSCL 09/1

Before proceeding to convergent cathodes, it was modified as indicated. The first portion of this contract concentrated on reproducing the prior art of tungstate cathodes in a planar device. To summarize, while the emission has been reached for a brief period of time, the longer term emission is only about one-half of that expected. A program for improving the emission is still underway. In the meantime, two diodes with curved electrodes have been prepared. Also, a beam tester has been designed and is partially built. Author (GRA)

N77-18368# Raytheon Co., Waltham, Mass.
DISTRIBUTED FERRITE ISOLATION IN TRAVELING-WAVE TUBES Final Technical Report, Jun. 1974 - May 1976
John M. Osepchuk and Daniel Masse Jul. 1976 109 p refs
(Contract N00014-74-C-0322; NR Proj. 251-016; RF54581001)
(AD-A029416; S-2062) Avail: NTIS HC A06/MF A01 CSCL 09/1

This report presents the results of a two year program to demonstrate the feasibility of achieving wideband isolation in high power (approximately 1 KW CW, 2 KW peak) traveling-wave tubes. The program included cold test, analysis and hot test in one experimental tube. In attempting to achieve the widest band possible with TWTs, ferrite designs exploiting the existence of broadband edge modes were sought. This report describes the existence of two branches of such edge modes and evidence of coupling to at least one branch called the magnetostatic wave branch. Though somewhat restricted because of available space in the existing TWT (QKW 1750) the final tube assembly showed the ability to produce over 40 dB reverse loss over an octave band. The designed isolation was wiped out, however, by an unanticipated effect of the axial focussing field in the completed tube. Hot tests showed reasonable beam focussing at above 50-100 percent higher than usual focussing current. No degradation of the samarium-cobalt magnet was observed after tube bakeout (400 C in vacuum). A program to achieve a theoretical understanding of ferrite slab modes and helix ferrite interaction is recommended. The results of such a theoretical study should permit a more successful realization of distributed isolation in TWTs. Author (GRA)

N77-18369# ITT Electron Tube Div., Easton, Pa.
LONG-LIFE X-RAY TUBES FOR PORTABLE SOURCES Final Report, 1 Jun. 1975 - 31 May 1976
Charles L. Shackelford Aug. 1976 33 p
(Contract DAAB07-75-C-1334; DA Proj. 1S7-62705-AH-94)
(AD-A029918; ECOM-75-1334-F) Avail: NTIS HC A03/MF A01 CSCL 09/1

Work performed toward the development of a long-life X-ray tube for the portable AN/TAQ-2 X-ray system is described in this final report. The investigation resulted in two tube designs, both of which produced substantial life improvement. The principal factor in the life increase was improvement in the tube anode. One design for standard X-ray output showed a life increase by a factor of three. A second design which accepts a 20 percent reduction in X-ray output shows a 5 to 6 times increase in the original life. Recommendations for further development are given. Author (GRA)

N77-18370# Honeywell, Inc., Golden Valley, Minn. Ceramics Center.
MANUFACTURING METHODS AND TECHNIQUES FOR PIEZOELECTRIC TRANSFORMERS Quarterly Progress Report, 14 Jan. - 14 Apr. 1976
William B. Harrison Ft. Monmouth, N.J. ECOM 27 Aug. 1976 43 p refs
(Contract DAAB07-76-C-0008)
(AD-A029466; HONEYWELL-46548) Avail: NTIS HC A03/MF A01 CSCL 09/1

The report describes the progress and status of the program to establish a cost-effective production capability for 18mm and 25mm piezoelectric ceramic transformers. The results obtained on the first engineering samples are reviewed. Revisions in the design of the 18mm package are described as well as other design changes that have been implemented for the second engineering sample build. GRA

N77-18371# Colorado Univ., Boulder. Dept. of Electrical Engineering.
HETEROJUNCTION CONTACTS FOR TRANSFERRED-ELECTRON DEVICES Annual Summary Report, 28 Feb. 1975 - 31 Jan. 1976
Russell E. Hayes Sep. 1976 51 p refs
(Contract N00014-75-C-0472; NR Proj. 122-102)
(AD-A030283; ASR-1) Avail: NTIS HC A04/MF A01 CSCL 09/1

The aim of the research described in this annual report is the development of heterojunction contacts for transferred-electron devices involving the GaInAsP-InP heterojunction system, with InP being the transferred-electron material. The details of the growth of GaInAsP on InP by liquid phase epitaxy are described, and the evaluation of these heterojunctions is discussed. Some computer simulations of heterojunctions are described, and preliminary experimental results from GaInAsP-InP n-n heterojunction diodes indicate that the conduction band discontinuity is small for that system. Author (GRA)

N77-18372# Hughes Research Labs., Malibu, Calif.
THIN FILM OPTICAL SWITCH Quarterly Technical Report, 22 Jan. - 22 Apr. 1976
Gregory L. Tangonan May 1976 26 p refs
(Contract N00173-76-C-0113; NR Proj. 523-021)
(AD-A029985; QTR-1) Avail: NTIS HC A03/MF A01 CSCL 09/5

This program represents an effort to develop a thin film optical switch using integrated optics technology. The switching of the direction of propagation of a two-dimensionally confined optical beam between two-channel waveguides is achieved using an electro-optic phase grating. The waveguiding medium is a Ti-diffused LiNbO3 layer. The coupling of single-mode guides to single-mode guides by mode expansion and compression tapers is an integral part of the switch design. GRA

N77-18373# RCA Solid State Technology Center, Somerville, N.J.
HIGH-RELIABILITY, LOW-COST INTEGRATED CIRCUITS Quarterly Development Report No. 2, 3 May - 3 Aug. 1976 1976 28 p
(Contract N00039-76-C-0240; XF54586002)
(AD-A030048) Avail: NTIS HC A03/MF A01 CSCL 09/5

Wafer fabrication for sample generation has been completed through metallization processing on all types except the CD4027B. Photographs showing step coverage of various gold thicknesses in contact regions and step coverage of the protective overcoat layer over the gold interconnects have been prepared to aid evaluation of the critical experiments. A two-layer protective structure with improved adherence to gold-metallized integrated circuits has been developed. Initial samples of the various integrated circuits are complete or near completion, and electrical characterization is under way. The required life-test facilities are nearing completion. Author (GRA)

N77-18374# Naval Postgraduate School, Monterey, Calif.
THE COEFFICIENT SPACE APPROACH TO THE STABILITY OF MULTIDIMENSIONAL DIGITAL FILTERS Technical Report, Jan. - Mar. 1976
Daniel L. Davis Aug. 1976 21 p refs
(RR0000110)
(AD-A030160; NPS-53DV76081) Avail: NTIS HC A02/MF A01 CSCL 09/5

This report is concerned with the development of a new approach to the problem of stability for multidimensional, causal, recursive, 'all pole', digital filters. The distinguishing feature of this approach is that general stability criteria can be derived directly in terms of the coefficients of the transfer function of the filter. Thus by use of this method it is sometimes possible to determine which coefficients of the transfer function are critical to the stability of the filter, information which is, of course, important in filter design. Also the emphasis of this approach is on the development of a conceptual method for considering the problem in complete generality. Author (GRA)

N77-18375# Lincoln Lab., Mass. Inst. of Tech., Lexington.
INTEGRATED OPTICAL CIRCUITS AND EXPLORATORY MATERIALS RESEARCH Semiannual Technical Summary Report, 1 Jul. - 31 Dec. 1975
Ivars Melngailis 31 Dec. 1975 16 p refs
(Contract F19628-76-C-0002; ARPA Order 2074)
(AD-A029433; ESD-TR-76-117) Avail: NTIS HC A02/MF A01 CSCL 20/6

Two types of low-loss single-mode P(+)n(-)n(+) GaAs three-dimensional waveguides have been successfully fabicated and their attenuation coefficients measured. The devices are an optical stripline and a new device, the channel-stop strip guide. The channel-stop strip guides have losses of 0.8 per cm at 1.06 micrometers and 1.1 per cm at 0.920 micrometers; the losses for the optical striplines are 1.2 per cm at 1.06 micrometers and 1.7 per cm at 0.920 micrometers. A first-order loss calculation has yielded attenuation coefficients within 25 percent of these measured values. Both structures have an n(-) substrate, an n(-) epitaxial layer for guiding, and p(+) regions to laterally confine the light. The p(+) regions have a uniform concentration and are formed by multiple-energy Be(+)-ion implantation. The p(+)n(-) junctions show sharp high-voltage breakdowns at sufficiently high electric fields in the n(-) layer (150,000.V/cm) to enable their use in directional-coupler switches and electroabsorption modulators. The causes for reduced external quantum efficiencies in integrated etched-mesa GaAs-AlGaAs double-heterostructure (DH) lasers have been investigated. The primary loss mechanism appears to be the scattering of light by imperfections in the etched end mirrors. GRA

N77-18376# Dayton Univ., Ohio. Dept. of Physics.
INVESTIGATION OF OPTICAL AND ELECTRICAL PROPERTIES OF WIDE BAND GAP MATERIALS Final Report, Jun. 1972 - Dec. 1975
Phil Won Yu, Samuel Faile, Hans Stocker, and James Schneider Wright-Patterson AFB, Ohio AFAL Jun. 1976 154 p refs
(Contract F33615-72-C-2114; AF Proj. 7885)
(AD-A030792; AFAL-TR-76-56) Avail: NTIS HC A08/MF A01 CSCL 20/12

This report concerns research on the optical and electrical properties of I-III-VI2 chalcopyrite compounds, HgS, ZnSe, and GaAs. Seventeen of the I-III-VI2 compounds were grown by melt-growth and vapor-phase method. HgS crystals were mainly grown by a modified iodine transport technique with small addition of NH4Cl. Anmalous temperature dependence of

energy gaps in I-III-VI compounds having d-electron was determined for AgGaS2 and CuInSe2 from photoluminescence, absorption, and reflection and was explained by the temperature dependent p-d hybridization. Broad-band luminescence dominating in AgGaS2 and CuInSe2 was influenced by heat-treatment, which indicates that intrinsic defects are responsible for the band. The electrical transport measurements lead to an understanding of the role of intrinsic defects in conduction mechanisms in CuGaS2, AgGaS2, CuInSe2, and ZnSe. Homojunction diode in CuInSe2 was prepared by both diffusion and implantation techniques using Cd, Br, Zn and Cl. The p-n junction showed efficient electroluminescence as well as efficient photodetection characteristics. In GaAs, the oscillatory photoconductivity was observed. Author (GRA)

N77-18377# National Bureau of Standards, Washington, D.C. Electronic Technology Div.

THE APPLICATION OF TEST STRUCTURES AND TEST PATTERNS TO THE DEVELOPMENT OF RADIATION HARDENED INTEGRATED CIRCUITS: A REVIEW Final Report

K. F. Galloway and M. G. Buehler Jul. 1976 16 p refs Sponsored by DNA

(AD-A029976; NBSIR-76-1093) Avail: NTIS HC A02/MF A01 CSCL 09/5

Government sponsored research and development on semiconductor devices intended for application in radiation environments often relies on test structures arranged into test patterns for device design information and process characterization. Problems unique to a radiation environment are often analyzed using test structures such as MOS capacitors and break-out transistors. The work reviewed in this report demonstrates the importance of test structures in isolating and identifying problem areas. However, the measurement methodology associated with test structures is seldom reported which makes it difficult to compare the results of different workers. Also, the work reported to date using test structures and test patterns for assessing radiation effects has involved the relatively slow-speed laboratory testing of statistically insignificant numbers of test structures. Test patterns could be used by buyers of radiation hardened devices for (1) vendor selection and qualification, (2) process validation for hardness screening and hardness assurance, and (3) identification of circuit parameters critical to hardness assurance. GRA

N77-18378# McDonnell-Douglas Automation Co., St. Louis, Mo.

INTEGRATED CIRCUIT ELECTROMAGNETIC SUSCEPTIBILITY INVESTIGATION, PHASE 3

J. M. Roe, J. R. Chott, C. E. Clous, W. H. Coalson, R. D. VonRohr, and D. R. Williams 4 Jun. 1976 92 p refs

(Contract N60921-76-C-A030; XF54585001)

(AD-A030019; MDC-E1513; NSWC/DL-TR-3504; TR-1) Avail: NTIS HC A05/MF A01 CSCL 09/5

Reported is the progress made in investigations of the susceptibility of semiconductor integrated circuits ICS to microwave energy. This report covers work performed in the first of three increments of the IC susceptibility task. The microwave effects on semiconductor integrated circuits have been studied, and susceptibility mechanisms for pn junctions and transistors have been identified. These effects are the basis for modeling the microwave effects in integrated circuits. Testing to provide data for the modeling has been performed. The susceptibility investigation for this increment centers on interference effects. Susceptibility reduction is being investigated through use of lossy ferrite materials and screening of devices to find the least susceptible ones. The dissemination and use of IC susceptibility information through the first draft of a handbook for system designers is also included. Author (GRA)

N77-18379# Naval Ship Research and Development Center, Bethesda, Md. Materials Dept.

APPLICATION OF COAST-DOWN MONITORING TECHNIQUE FOR VERTICAL SHAFT MOTORS

Robert J. Craig Sep. 1976 22 p ref

(ZF61512001)

(AD-A030412; MAT-76-13) Avail: NTIS HC A02/MF A01 CSCL 09/3

The application of a technique to predict the coast-down behavior of vertically mounted electric motors is described. The technique gives an estimate of the coast-down time, as well as a determination of the shape of the speed/time curve, to be expected when the motors are equipped with grease-lubricated, deep-groove ball bearings and operated free of installation and assembly errors. Thus, a practical means to assess the mechanical condition of vertically mounted electric motors is provided by comparing their actual (measured) coast-down behavior with that predicted by the technique. Author (GRA)

N77-18380# Cornell Univ., Ithaca, N.Y.

ASSESSMENT OF SOLID STATE REPLACEMENT OF TWT AMPLIFIERS FOR SATELLITE COMMUNICATIONS Interim Report, Apr. 1975 - May 1976

G. C. Dalman, L. F. Eastman, C. A. Lee, J. Frey, and W. Ku Griffiss AFB, N. Y. RADC Aug. 1976 112 p refs

(Contract F30602-74-C-0001; AF Proj. 5573)

(AD-A030797) Avail: NTIS HC A06/MF A01 CSCL 09/1

This report summarizes the present state-of-the-art achievements of GaAs FET transistors, assesses their probable capabilities and the associated technology problems. Designs of FET high power amplifiers are included and it is noted that measured intermodulation distortion in these amplifiers is higher than anticipated. Finally it is shown that efficient high power GaAs Read diodes of the hard punch-on variety can satisfy the TWTA distortion specifications. Thus an FET/Read diode hybrid amplifier is proposed that should meet all specifications except that of overall efficiency which would probably be reduced to 20-25%. Author (GRA)

N77-18381# Naval Research Lab., Washington, D.C. Plasma Physics Div.

DEPENDENCE OF THE ION CURRENT ON VOLTAGE IN A REFLEX TRIODE Interim Report

C. A. Kapetanakos, J. Golden, and W. M. Black Sep. 1976 18 p refs

(NRL Proj. H02-28A)

(AD-A030870; NRL-MR-3372) Avail: NTIS HC A02/MF A01 CSCL 09/1

Results are reported on the dependence of the current of a pulsed ion beam produced in a reflex triode upon the applied resistive voltage in the range 0.6 to 1.3 MV. The measured peak ion current at the maximum voltage tested is 20 kA, corresponding to a current density of 200 A/sq.cm.

Author (GRA)

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N77-18382* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

PARTICULATE AND SOLAR RADIATION STABLE COATING FOR SPACECRAFT Patent

Wayne S. Slemp, inventor (to NASA) Issued 15 Feb. 1977 4 p Filed 16 May 1975 Supersedes N75-29431 (13 - 20, p 2526) Continuation-in-part of abandoned US Patent Appl. SN-428992, filed 27 Dec. 1973

(NASA-Case-LAR-10805-2; US-Patent-4,008,348; US-Patent-Appl-SN-578240; US-Patent-Class-428-35; US-Patent-Class-428-421; US-Patent-Class-428-461; US-Patent-Class-428-474; US-Patent-Class-244-117A; US-Patent-Class-427-160; US-Patent-Class-427-322; US-Patent-Appl-SN-428992) Avail: US Patent Office CSCL 20D

A laminate thermal control coating for spacecraft comprising a layer of solar radiation stable film, a layer of particulate radiation stable film applied to the upper surface of the solar radiation stable film, and a layer of reflecting material applied to the lower surface of the solar radiation stable film was described. The coating experiences no increase in solar radiation absorptance

(the proportion of radiant energy absorbed) upon exposure to particulate or solar radiation as the particulate radiation is substantially absorbed in the particulate radiation stable layer and the solar radiation partially absorbed by the particulate radiation stable layer is transmitted by the solar radiation stable film to the reflecting material which reflects it back through the laminate and into space.

Official Gazette of the U.S. Patent Office

N77-18383*# Maryland Univ., College Park. Inst. for Physical Science and Technology.

CONCEPTS AND METHODS FOR DESCRIBING CRITICAL PHENOMENA IN FLUIDS

J. V. Sengers and J. M. H. Levelt Sengers (NBS, Washington, D.C.) [1976] 161 p refs

(Grant NGR-21-002-344)

(NASA-CR-149665) Avail: NTIS HC A08/MF A01 CSCL 20D

The predictions of theoretical models for a critical-point phase transistion in fluids, namely the classical equation with third-degree critical isotherm, that with fifth-degree critical isotherm, and the lattice gas, are reviewed. The renormalization group theory of critical phenomena and the hypothesis of universality of critical behavior supported by this theory are discussed as well as the nature of gravity effects and how they affect cricital-region experimentation in fluids. The behavior of the thermodynamic properties and the correlation function is formulated in terms of scaling laws. The predictions of these scaling laws and of the hypothesis of universality of critical behavior are compared with experimental data for one-component fluids and it is indicated how the methods can be extended to describe critical phenomena in fluid mixtures. Author

N77-18384# Deutsche Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).

PREDICTION OF TERMINAL SPEED RATIOS IN SPHERICAL-SOURCE EXPANSIONS

Ashok U. Chatwani 1 Mar. 1977 31 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Jun. 1977

Avail: NTIS HC A03/MF A01

The direct simulation Monte Carlo method was used to obtain the terminal speed ratios for the spherical source expansion of Helium, Neon, and the hard sphere gas. Results are used to examine the validity of the sudden freeze model in predicting the terminal speed ratios. Parameters are used to characterize the location of the freeze surface. A range of values between .2 and 3.3 is used to correlate all the results. Departures from a constant value are attributed to the non-Maxwellian nature of the distribution function for the parallel direction. Author

N77-18385*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

REEVALUATION OF COMPRESSIBLE-FLOW PRESTON TUBE CALIBRATIONS

Jerry M. Allen Feb. 1977 25 p refs

(NASA-TM-X-3488; L-11189) Avail: NTIS HC A02/MF A01 CSCL 20D

Revised zero-pressure-gradient, adiabatic wall skin-friction-balance data covering a Mach number range from 1.6 to 4.6 led to a reevaluation of existing compressible flow Preston tube calibration equations. Author

N77-18386*# Martin Marietta Corp., Denver, Colo.

THERMAL CONTROL OF POWER SUPPLIES WITH ELECTRONIC PACKAGING TECHNIQUES Final Report

Feb. 1977 145 p refs

(Contract NAS8-31799)

(NASA-CR-150194; DCN-1-6-EC-03940; MCR-77-8) Avail: NTIS HC A07/MF A01 CSCL 20D

The integration of low-cost commercial heat pipes in the design of a NASA candidate standard modular power supply with a 350 watt output resulted in a 44% weight reduction. Part temperatures were also appreciably reduced, increasing the environmental capability of the unit. A complete 350- watt modular power converter was built and tested to evaluate thermal performance of the redesigned supply. Author

N77-18387*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

DIFFRACTION OF A SHOCK WAVE BY A COMPRESSION CORNER; REGULAR AND SINGLE MACH REFLECTION

V. S. VijayaShankar, Paul Kutler, and Dale Anderson (Iowa State Univ., Ames) Nov. 1976 124 p refs

(NASA-TM-X-73178; A-6804) Avail: NTIS HC A06/MF A01 CSCL 20D

The two dimensional, time dependent Euler equations which govern the flow field resulting from the injection of a planar shock with a compression corner are solved with initial conditions that result in either regular reflection or single Mach reflection of the incident planar shock. The Euler equations which are hyperbolic are transformed to include the self similarity of the problem. A normalization procedure is employed to align the reflected shock and the Mach stem as computational boundaries to implement the shock fitting procedure. A special floating fitting scheme is developed in conjunction with the method of characteristics to fit the slip surface. The reflected shock, the Mach stem, and the slip surface are all treated as harp discontinuities, thus, resulting in a more accurate description of the inviscid flow field. The resulting numerical solutions are compared with available experimental data and existing first-order, shock-capturing numerical solutions. Author

N77-18388*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

THE FLOW FIELD OF AN UNDEREXPANDED H2 JET COAXIALLY INJECTED INTO A HOT FREE OR DUCTED SUPERSONIC JET OF AIR OR NITROGEN

Renaldo V. Jenkins Feb. 1977 35 p refs

(NASA-TM-X-74002) Avail: NTIS HC A03/MF A01 CSCL 20D

Experimental data obtained in an investigation of the mixing of an underexpanded hydrogen jet in a supersonic flow both with and without combustion are presented. Tests were conducted in a Mach 2 test stream with both air and nitrogen as test media. Total temperature of the test stream was 2170 K, and static exit pressure was about one atmosphere. The static pressure at the exit of the hydrogen injector's Mach 2 nozzle was about two atmospheres. Primary measurements included shadowgraphs and pitot pressure surveys of the flow field. Pitot surveys and wall static pressures were measured for the case where the entire flow was shrouded. The results are compared to similar experimental data and theoretical predictions for the matched pressure case. Author

N77-18389*# Transemantics, Inc., Washington, D.C.

STUDY OF AN SLN-TEST PLATFORM FOR THERMAL COMPONENTS (HEAT PIPES AND LATENT HEAT ACCUMULATORS)

Washington NASA Mar. 1977 18 p Transl. into ENGLISH from Studie einer SLN-Test plattform for Thermische Komponentem (Warmerohre und Latentwarmespeicher); West German report, Dec. 1976 p 1-16

(Contract NASw-2792)

(NASA-TT-F-16772) Avail: NTIS HC A02/MF A01 CSCL 20D

The SLN test platform made possible the examination of thermal components - heat pipes and latent heat accumulators in the module of the spacelab. The interface to the experiments is considerably simplified in the following points: safety regulations, mechanics, cooling, current supply, data acquisition and processing. Author

N77-18390*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

STAYLAM: A FORTRAN PROGRAM FOR THE SUCTION TRANSITION ANALYSIS OF A YAWED WING LAMINAR BOUNDARY LAYER

James E. Carter Mar. 1977 80 p refs

(NASA-TM-X-74013) Avail: NTIS HC A05/MF A01 CSCL 20D

A computer program called STAYLAM is presented for the computation of the compressible laminar boundary-layer flow over a yawed infinite wing including distributed suction. This program is restricted to the transonic speed range or less due to the approximate treatment of the compressibility effects. The

prescribed suction distribution is permitted to change discontinuously along the chord measured perpendicular to the wing leading edge. Estimates of transition are made by considering leading edge contamination, cross flow instability, and instability of the Tollmien-Schlichting type. A program listing is given in addition to user instructions and a sample case. Author

N77-18391# Bundesministerium der Verteidigung, Bonn (West Germany).

SELECTED CONTRIBUTIONS TO BALLISTICS [AUSGEWAEHLTE BEITRAEGE ZUR BALLISTIK]

R. Schall, comp. (Inst. Franco-Allemand de Rech.), G. Krauth, comp. (Inst. Franco-Allemand de Rech.) et al 1976 235 p refs Partly in GERMAN and partly in FRENCH; ENGLISH summaries

(BMVg-FBWT-76-18) Avail: NTIS HC A11/MF A01; DOKZENTBw DM 50

Topics are discussed in the fields of interior ballistics, spinning projectile trajectories and aerodynamics, and underwater ballistics. Gas dynamic models for interior ballistics are dealt with. A technique of microwave interferometry in interior ballistics with data transmission from the projectile is illustrated. Pendulous projectile trajectories are examined. The gyroscopic stability of spin stabilized projectiles is discussed, and aerodynamic coefficients and stability are determined. The ballistic range of the French-German Research Institute is described. A simple vulnerability model was established for targets. The underwater trajectory of a rocket was studied. For individual titles, see N77-18392 through N77-18401.

N77-18392# Institut Franco-Allemand de Recherches, St. Louis (France).

SIMULATION OF INTERIOR BALLISTICS PHENOMENA IN COMPUTATIONAL GAS DYNAMIC MODELS

K. Hoog *In* Bundesmin. der Verteidigung Selected Contrib. to Ballistics 1976 p 4-34 refs In GERMAN; ENGLISH summary (For primary document see N77-18391 09-34)

Avail: NTIS HC A11/MF A01; DOKZENTBw DM 50

A schematic diagram was drawn up presenting possible gasdynamic models for interior ballistics. Partial problems are described arising from the treatment in flow mechanics of the interior ballistics of guns. The approximation to the various phenomena encountered is outlined in the different models. Of interest are not only the physical aspects but also the numerical treatment of the simulation models. A two-phase model is reviewed using a method of finite differences in Eulerian coordinates. Results of a test calculation for the 20 mm gun of the Rh 202 type are compared with the corresponding computation performed with the aid of a method of characteristics.

Author (ESA)

N77-18393 Institut Franco-Allemand de Recherches, St. Louis (France).

A METHOD OF CHARACTERISTICS IN LAGRANGE COORDINATES USED IN INTERIOR BALLISTICS

G. Krauth *In* Bundesmin. der Verteidigung Selected Contrib. to Ballistics 1976 p 35-52 refs In GERMAN; ENGLISH summary (For primary document see N77-18391 09-34)

Avail: NTIS HC A11/MF A01; DOKZENTBw DM 50

A simulation model based on gas dynamics and used in interior ballistics is dealt with. The equations established under certain assumptions (application of the theory of stream filaments, complete entrainment of the powder, no subsequent reaction of the combustion products) are numerically solved using a method of characteristics in Lagrange coordinates. Curves are plotted for a practical example illustrating the computed results. In spite of sometimes not satisfying input data, the results achieved were found to be in good agreement with the characteristics of the chosen weapon. Author (ESA)

N77-18394# Institut Franco-Allemand de Recherches, St. Louis (France).

GAS PRESSURE VARIATION IN A CLARINET-TYPE BARREL

K. Zimmermann *In* Bundesmin. der Verteidigung Selected Contrib. to Ballistics 1976 p 53-67 In GERMAN; ENGLISH summary (For primary document see N77-18391 09-34)

Avail: NTIS HC A11/MF A01; DOKZENTBw DM 50

An experimental gun of 20 mm in caliber equipped with a clarinet-type barrel was used to investigate the variation in gas pressure at both the breech and projectile base. A computing model based on gas dynamics was established and used for comparing the experimental results achieved with those obtained in the field of conventional interior ballistics. Only in a few cases the latter can be regarded as a good approximation with respect to true conditions. Parametric studies of the change in the geometry of the combustion chamber, cone angle in the barrel, and rotating band of the projectile allow estimation, qualitatively and quantitatively, of the effects on the total variation in gas pressure within the barrel. Author (ESA)

N77-18395# Institut Franco-Allemand de Recherches, St. Louis (France).

SIGNAL SHAPE IN MICROWAVE INTERFEROMETRY USED FOR INCLUSIVE BALLISTICS WITH DATA TRANSMISSION FROM WITHIN THE PROJECTILE

J. Biele *In* Bundesmin. der Verteidigung Selected Contrib. to Ballistics 1976 p 68-83 refs In GERMAN; ENGLISH summary (For primary document see N77-18391 09-34)

Avail: NTIS HC A11/MF A01; DOKZENTBw DM 50

The technique of microwave interferometry used in interior ballistics with data transmission from the projectile is illustrated. On the basis of the complex reflection coefficient of the electromagnetic waves generated in the projectile and picked up at the muzzle, the square wave sample function of which can be used as a data carrier, is then represented analytically on the detector of the microwave interferometer. Signal processing in view of the separation of Doppler and sample frequencies by means of high-pass and low-pass filtering is explained.

Author (ESA)

N77-18396# Institut Franco-Allemand de Recherches, St. Louis (France).

DETERMINATION OF PENDULOUS PROJECTILE TRAJECTORIES

V. Fleck *In* Bundesmin. der Verteidigung Selected Contrib. to Ballistics 1976 p 84-95 refs In GERMAN; ENGLISH summary (For primary document see N77-18391 09-34)

Avail: NTIS HC A11/MF A01; DOKZENTBw DM 50

A new simplified system of equations of motion was established allowing quick computation of the trajectories of pendulous projectiles. The essential characteristic of this system is that it is limited to axisymmetric projectiles, excluding, therefore, the necessity of determining the angle of roll. The related computer program offers the possibility of entering the aerodynamic coefficients both as function of the Mach number and as function of the angle of incidence. Thus, it is also suited to the computation of trajectories presenting very large angles of pendulation. The choice of appropriate reference systems and variables allowed numerical determination of the maximum quantity of motion using a normal capacity. A FORTRAN program was written allowing the pendulum motion of projectiles in the initial portion of the trajectory to be computed in a few minutes, using a computer of the IBM 370-135 type. Even for maximum flight times the determination of entire trajectories will not exceed 1 hour of computation. Author (ESA)

N77-18397# Institut Franco-Allemand de Recherches, St. Louis (France).

GYROSCOPIC STABILITY COEFFICIENT OF SPIN-STABILIZED CONE CYLINDER PROJECTILES OF P3C SHAPES

M. Giraud *In* Bundesmin. der Verteidigung Selected Contrib. to Ballistics 1976 p 96-142 refs In FRENCH; ENGLISH summary (For primary document see N77-18391 09-34)

Avail: NTIS HC A11/MF A01; DOKZENTBw DM 50

The development of a practical method is described which allows the coefficient of gyroscopic stability of spin-stabilized projectiles to be determined with a very good approximation. The method is applied to the particular case of the homogeneous cone-cylinder projectile. The extension of the method to more generalized projectile shapes (ogive-cylinder projectiles, projectiles with particular internal structure) is possible. The particular case of a homogeneous cone-cylinder projectile launched with the gun of the 30L80 type from a rifled barrel at an angle of rifling of 7 deg 30 min is treated as an example. Theoretical and

experimental results are compared and found to be in excellent agreement. Modifications made to the nose of the cone-cylinder projectile in view of its operational use remain without effect on the coefficient of gyroscopic stability. Author (ESA)

N77-18398# Institut Franco-Allemand de Recherches, St. Louis (France).

PROGRAM FOR ESTIMATING THE AERODYNAMIC COEFFICIENTS AND STABILITY OF SPIN-STABILIZED PROJECTILES

E. Mayer *In* Bundesmin. der Verteidigung Selected Contrib. to Ballistics 1976 p 143-156 refs In GERMAN; ENGLISH summary (For primary document see N77-18391 09-34)
Avail: NTIS HC A11/MF A01; DOKZENTBw DM 50

A program was established which allows rapid computation of the drag coefficient as well as the criteria of stability of spin-stabilized supersonic projectiles. This program is essentially based on empirical formulae. The program flow is illustrated with the aid of an example, and the results achieved are compared with measurements performed in the wind tunnel. Author (ESA)

N77-18399# Institut Franco-Allemand de Recherches, St. Louis (France).

AEROBALLISTIC INVESTIGATIONS IN THE CONVENTIONAL BALLISTIC RANGE OF THE FRENCH-GERMAN RESEARCH INSTITUTE

M. Giraud *In* Bundesmin. der Verteidigung Selected Contrib. to Ballistics 1976 p 158-187 refs In FRENCH; ENGLISH summary (For primary document see N77-18391 09-34)
Avail: NTIS HC A11/MF A01; DOKZENTBw DM 50

A review is presented of the possible uses presently offered by the conventional ballistic range of the institute. The review, covering a period of 15 years, shows that the ballistic range remains an important experimental facility, allowing determination of the aeroballistic data of projectiles. Author (ESA)

N77-18400# Institut Franco-Allemand de Recherches, St. Louis (France).

SIMPLE VULNERABILITY MODEL

V. Fleck and E. Meyer *In* Bundesmin. der Verteidigung Selected Contrib. to Ballistics 1976 p 188-201 In GERMAN; ENGLISH summary (For primary document see N77-18391 09-34)
Avail: NTIS HC A11/MF A01; DOKZENTBw DM 50

In order to determine the vulnerability of a target, a model was developed which, in contrast to usual procedures, does not make use of the Monte Carlo method. For one determination of the vulnerability of the target, each component is considered only once and, according to its size, position and destruction sensitivity, its contribution to the probability of destroying the target is determined. It was possible to achieve very short computing times. The method is illustrated with the aid of an example, and the range of its possible use is shown.
Author (ESA)

N77-18401# Institut Franco-Allemand de Recherches, St. Louis (France).

THEORETICAL STUDIES ON UNDERWATER BALLISTICS. COMPUTATION OF THE CENTER OF GRAVITY MOTION OF ROCKETS IN AIR AND WATER

R. Trotz and G. Krauth *In* Bundesmin. der Verteidigung Selected Contrib. to Ballistics 1976 p 202-230 refs In GERMAN; ENGLISH summary (For primary document see N77-18391 09-34)
Avail: NTIS HC A11/MF A01; DOKZENTBw DM 50

A newly established computer program was used to calculate the motion of the center of gravity of rockets immersing from air in water. Possible rocket propulsion is supposed to be activated when reaching the air-water interface. The immersion conditions for horizontal launching of secondary projectiles after decomposition of the rocket were determined. In the case of horizontal launching, the influence of various parameters such as caliber, impact velocity, hydrodynamic resistance, and burning velocity of the propellant charge, was investigated in depths down to 300 m. Particular attention was paid to the time needed to reach a given water depth. The criterion chosen for determining the efficiency of rocket propulsion was the ratio of the trajectory durations with and without propulsion. Minimum water depths were determined for a given value. Limit velocities and durations of descent are given. The influence of cavitation phenomena was approximated by using a strongly reduced resistance coefficient. Propulsion in water was found to be of advantage in most cases, but the quantity of explosive carried along is reduced. Author (ESA)

N77-18402# Sandia Labs., Albuquerque, N.Mex.

ANALYTICAL MODELING AND EXPERIMENTAL VERIFICATION OF THE PERFORMANCE OF A LOW TEMPERATURE ABLATIVE MATERIAL

Ronald B. Pope 1976 38 p refs Presented at the 11th Thermophys. Conf., San Diego, Calif., 14 Jul. 1976 Sponsored by ERDA
(SAND-76-6237; Conf-760708-1) Avail: NTIS HC A03/MF A01

A description is presented of the development and verification of a computer model of the ablation of Thermo-lag T-230, a low temperature ablator. The model is constructed utilizing a basic understanding of the decomposition behavior of the material in a thermal environment. An existing and readily available general numerical analysis computer program is used, and the modeling serves as input to that program. The model adequately predicts both the temperature and mass loss histories of T-230 heatshields exposed to various aerothermodynamic environments including radiant heating and arc heated convective exposures, and the ascent heating environment of a suborbital, exoatmospheric flight vehicle. ERA

N77-18403# Los Alamos Scientific Lab., N.Mex. Theoretical Div.

NUMERICAL METHOD FOR TWO-DIMENSIONAL UNSTEADY REACTING FLOWS

T. D. Butler and P. J. ORourke 1976 35 p refs Presented at 16th Intern. Symp. on Combust., Cambridge, Mass., 15-21 Aug. 1976
(Contract W-7405-eng-36)
(LA-UR-76-1229; Conf-760805-14) Avail: NTIS HC A03/MF A01

A method that numerically solves the full two-dimensional, time-dependent Navier-Stokes equations with species transport, mixing, and chemical reaction between species is presented. The generality of the formulation permits the solution of flows in which deflagrations, detonations, or transitions from deflagration to detonation are found. The solution procedure is embodied in the RICE computer program. RICE is an Eulerian finite difference computer code that uses the implicit continuous-fluid Eulerian technique to solve the governing equations. The differential equations of motion and the solution procedure of the RICE program are stipulated. Next, a method is described for artificially thickening the combustions zone to dimensions resolvable by the computational mesh. Finally, the results of two example calculations are presented. ERA

N77-18404# Sandia Labs., Albuquerque, N.Mex.

BOUNDARY LAYER SOLUTIONS FOR NATURAL CONVECTION IN POROUS MEDIA

Harry C. Hardee May 1976 33 p refs
(Contract AT(29-1)-987)
(SAND-76-0075) Avail: NTIS HC A03/MF A01

An approximate solution is developed for natural convection in porous media resulting from localized heat sources. The method is applicable for moderate levels of convection. Results of the method compare well with those of other calculational methods and with experimental data. The solution for a spherical source is used as an indirect method for the determination of permeability in some cases. ERA

N77-18405# Oak Ridge National Lab., Tenn.

BOILING HEAT TRANSFER PROBLEMS IN A TOKAMAK

A. P. Fraas 1976 17 p refs Presented at 16th Natl. Heat Transfer Conf. of the Am. Inst. of Chem. Engr., St. Louis, 8-11 Aug. 1976 Sponsored by ERDA
(CONF-760816-6) Avail: NTIS HC A02/MF A01

A prime incentive to employ a potassium or cesium boiler submerged in a recirculating lithium blanket is that this arrangement gives the most uniform temperature distribution through the blanket and hence the lowest thermal stresses of any configuration that was proposed. The principal problems

currently envisioned are associated with the MHD effects on the liquid feed flow to the boiler tubes and a possibly unsatisfactory boiler feed flow distribution because of the differences in pressure drop in the feed lines from one region to another as a consequence of differences in magnetic field strength and line lengths. Various ways of coping with these problems were considered and their relative merits were appraised. ERA

N77-18406# Brookhaven National Lab., Upton, N.Y.
CONRAD: HEAT CONDUCTION-RADIATION CODE, PART 1
J. A. Fillo, R. Benenati, and J. R. Powell Feb. 1976 56 p refs
(Contract E(30-1)-16)
(BNL-50504) Avail: NTIS HC A04/MF A01

A computer code is developed for two-dimensional, nonsteady heat conduction in heterogeneous, anisotropic solids with nonuniform volumetric internal heating. Thermal radiation and arbitrary heat flux boundary conditions are accommodated. Coolant tubes are taken into account by prescribing fluid temperatures and heat transfer coefficients. With regard to coolant tubes, allowance was made for: (1) heat capacitance in the tube wall, coolant tube in contact with the structural material; (2) zero capacitance in the tube wall, coolant tube in contact with the structural material; and (3) zero heat capacitance in the tube wall, radiation gap between the wall and structure. ERA

N77-18407# Arbeitsgruppe fuer Ballistische Forschung, Weil am Rhein (West Germany).
HODOGRAPH METHOD FOR UNSTEADY ONE-DIMENSIONAL GAS FLOW [HODOGRAPHENVERFAHREN FUER INSTATIONAERE EINDIMENSIONALE GAS-STROEMUNGEN]
Rudi Heiser Bonn DOKZENTBw 1976 123 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(BMVg-FBWT-76-16) Avail: NTIS HC A06/MF A01; DOKZENTBw DM 40

Fundamental equations are described and transformed into the hodograph plane for the unsteady one-dimensional flow of a Nible-Abel gas with energy and mass influx and with a cross section variable in space and time. Numerical solutions are given using a difference method having characteristics in the hodograph plane as grid. A further solution is indicated by means of the Darboux differential equation. Applications of the method are described for instantaneous one-dimensional flow in internal combustion engines and interior ballistics. ESA

N77-18408# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
A VARIATIONAL APPROACH TO NONLINEAR WAVE THEORY Final Report
Robert W. Whalin Aug. 1976 48 p refs
(DA Proj. 4A0-61101-A-91D)
(AD-A030144; WES-MP-H-76-16) Avail: NTIS HC A03/MF A01 CSCL 20/4

A variational approach to nonlinear wave theory is explored by deriving the equations of motion for four small amplitude constant depth theories, two finite amplitude constant depth theories, and one small amplitude variable depth theory. It is determined that the rotational wave theories derived are more appealing than the irrotational theories. The characteristic relation is explored for the above theories and the effect of vertical velocity on wave reflection is investigated. Further numerical and experimental efforts are warranted to investigate the validity of the equations of motion for describing shallow water wave phenomena. Although the methodology used requires conservation of energy, the possibility exists that a variational approach might be derived for a nonconservative system (thus allowing frictional energy dissipation and energy loss by breaking). GRA

N77-18409# ARO, Inc., Arnold Air Force Station, Tenn.
CONDENSATION SCALING LAWS FOR RESERVOIR AND NOZZLE PARAMETERS AND GAS SPECIES AS DETERMINED BY LASER SCATTERING EXPERIMENTS Interim Report, 1 Jul. 1974 - 30 Jun. 1975
W. D. Williams and J. W. L. Lewis AEDC Sep. 1976 47 p refs
(ARO Proj. V32S-11A; ARO Proj. V32S-51A)
(AD-A029733; ARO-VKF-TR-76-16; AEDC-TR-76-67; AFRPL-TR-76-38) Avail: NTIS HC A03/MF A01 CSCL 20/4

A study of the condensation of gases in expansion flow fields has been performed using laser Rayleigh scattering with the goal of determining the dependence of the spatial location of onset and subsequent condensate growth with gas reservoir conditions, gas source parameters, and gaseous species. Sonic orifice and conical nozzle expansions of N2 were studied for the range of reservoir pressure values from 0.26 to 10.2 atm at a nominal reservoir temperature of 285K. The conical nozzle expansions included the nozzle half angles of 5.60, 9.0, and 14.5 deg. Finally, sonic orifice expansions produced by sources of two different diameters were investigated for flow fields of Ar, N2, O2, and CO. GRA

N77-18410# Ballistic Research Labs., Aberdeen Proving Ground, Md.
EVALUATION OF SIMPLE MODELS FOR THE ATTENUATION OF SHOCK WAVES BY VENTED PLATES Final Report
Fritz H. Oertel, Jr. Aug. 1976 54 p refs
(AD-A029716; BRL-1906) Avail: NTIS HC A04/MF A01 CSCL 20/4

In this report, the attenuation of shock waves upon passing through vented plates is analyzed using simple one-dimensional flow models. Inviscid, nonconducting ideal diatomic gas is assumed. Transmission of shock waves through single plates and through arrays of several plates in series is considered. Models are compared with each other and with experiment. One model is found to be easier to use and less time-consuming, and, simultaneously, agrees best with the experimental results over a wide range of conditions. Author (GRA)

N77-18411# Ballistic Research Labs., Aberdeen Proving Ground, Md.
A PERTURBATION EXPANSION OF THE NAVIER-STOKES EQUATIONS FOR SHOCK WAVES
John D. Powell and Jad H. Batteh Sep. 1976 32 p refs
(DA Proj. 1W1-61102-AH-43)
(AD-A030357; BRL-1927) Avail: NTIS HC A03/MF A01 CSCL 20/4

A systematic perturbation expansion is developed for the steady-state Navier-Stokes equations describing shock propagation in an ideal gas. The temperature dependence of the viscosity and thermal conductivity is accounted for, though the specific heat and Prandtl number are assumed constant. It is shown that if the first n-1 terms in the expansion are known, the n th term can always be expressed in terms of a quadrature. Explicit calculation of the expansion is carried out to second order in the shock strength, and the results are compared with a special-case exact calculation. It is shown that the results are in surprisingly good agreement with the exact calculation even for rather strong shock waves. The effect on shock structure of the temperature-dependent transport coefficients is discussed. Author (GRA)

N77-18412# Illinois Inst. of Tech., Chicago. Dept. of Mechanics Mechanical and Aerospace Engineering.
GENERATION AND MANAGEMENT OF SWIRLING FLOWS IN CONFINED STREAMS Interim Technical Report, 1 Jun. 1974 - 1 Jun. 1976
M. Ahmed, R. A. Wigeland, and H. M. Nagib Jun. 1976 323 p refs
(Grant DAHC04-74-G-0160)
(AD-A029418; IIT-R76-2; ARO-ITR-76-1) Avail: NTIS HC A14/MF A01 CSCL 20/4

An experimental investigation of techniques for generating, measuring and controlling swirling flows in confined streams has been carried out. Several typical swirling flows were generated, and their careful calibration was carried out using hot-wire anemometers and miniature vane-vorticity indicators. By inserting in these flows various flow manipulators, such as honeycombs, screens and perforated plates, a comparison of the characteristics of the flow downstream of the manipulators (e.g., distribution of streamwise vorticity) to the original test flows provided a measure of the effectiveness of the manipulators in suppressing large scale vorticity as well as clues to dominant

mechanism of the flow transformations. It has been found that the effectiveness of a manipulator in suppressing the swirl conditions is reduced somewhat as the strength of the swirl upstream of it is increased, and is improved as the width of the vortex is increased while its strength remains the same. Although honeycombs have a high efficiency in suppressing swirl, their optimum mesh depends on the size of the swirl. The pressure drop across the manipulator, which plays an important role in design of wind tunnels and flow ducts, appears to play a minor role in the management of swirling flows. Recommended procedures for control of large scale swirling and secondary flows are developed, and general concepts are obtained which design and test engineers can adapt for 'tailoring and manipulating' their own special flows with different rotational characteristics.
Author (GRA)

N77-18413# Brown Univ., Providence, R. I. Div. of Engineering.
LIMIT MODELING OF THERMAL TURBULENCE IN UNSTABLY STRATIFIED FLOWS
Joseph H. Clarke Jul. 1976 44 p refs
(Contracts N00014-76-C-0154; N00014-67-A-0191-0021; NR Proj. 061-203)
(AD-A030802) Avail: NTIS HC A03/MF A01 CSCL 20/4

A new, relatively simple, rational, and viable theory of phenomenological thermal turbulence occurring in incident unstably stratified fluid flows is discussed. The subject of stratified flow has consisted largely of the study of stably stratified incident flows and of unstable thermal convection of a fluid heated from below with no incident flow. The new turbulence theory is intermediate in complexity between the turbulent eddy-transport theory and the very complex generic theory known as 'turbulence modeling'. The method is called 'a limit theory of phenomenological thermal turbulence modeling'; based on a system of plausibly large and small parameters, it is more suitable in many applications where the said parameters behave as required; moreover, the theory lends itself to systematic improvement. The research consists of a study of turbulent cellular flow due to an unstable temperature stratification underneath a flow with a stable temperature stratification. These two layers are separated by an interface whose detailed structure is a pausal boundary layer. The turbulent thermal convection below buffets the upper layer by means of 'penetrative convection' and heats the upper layer at the interface because the turbulent heat flux mechanism must switch off. The penetrative convection and heat switch must amount to a 'heat engine' whereby the rate of work of thermal origin is done on the bottom of the upper layer. This power source can then produce internal, surface, and Kelvin-Helmholtz waves. GRA

N77-18414# AiResearch Mfg. Co., Torrance, Calif.
ADVANCED HEAT EXCHANGER DEVELOPMENT FOR ARMY MOBILE APPLICATIONS, ADDENDUM 1 Final Report, Jan. - Jul. 1976
Stanley Wong 30 Jun. 1976 27 p refs
(Contract DAAE07-76-C-0086; DA Proj. 1G6-63621-DG-07) (AD-A029751; AiResearch-75-11314-Add-1; TACOM-TR-12043-1-Add-1) Avail: NTIS HC A03/MF A01 CSCL 13/1

Two production radiator core sections were tested to obtain their basic heat transfer and pressure drop characteristics. Based on these test results a comparison is made with a plate-fin design developed under a previous contract (Report 12043). Slightly higher heat transfer performance was indicated for the plate-fin radiator over the two production units. Author (GRA)

N77-18415# Williams (John S.), Newbury Park, Calif.
SURVEY OF AVAILABLE SYSTEMS FOR IMPROVING HEAT TRANSFER IN AIR CONDITIONING CHILLER CONDENSERS Final Report, Feb. - Jul. 1976
John S. Williams Jul. 1976 16 p refs
(Contract N68305-76-C-0018; YF57571999)
(AD-A029378; CEL-CR-76.004) Avail: NTIS HC A02/MF A01 CSCL 13/1

A survey of available systems which claim to maintain or improve the heat transfer ability of air conditioning condensers was performed. Two systems were identified, both of German origin. One system called the 'M. A. N. On-Load Tube Cleaning System' uses small brushes to keep the condenser tubes clean. This system is distributed by Water Sevices of America, Inc. The other system, handled by Amertap of Mineola, New York, uses small foam rubber balls to maintain and clean the condenser tubes. Several users of these systems were identified and visited. The M. A. N. system appears to require less day to day maintenance and is more widely used. In view of the many modified air conditioning units located at non-governmental organizations, it is considered unnecessary to conduct formal tests before approving the general use of the M. A. N. system. It is recommended however, that a comparison test be made of the two systems. Because performance data are more easily obtained from centrifugal chillers than other systems, this type should be the first modified. Performance data should be obtained both before and after installation to verify the two year payback period predicted in this report. Locations in the Washington, D.C., or Norfolk area look most promising. Author (GRA)

N77-18416# DCW Industries, Sherman Oaks, Calif.
NUMERICAL SIMULATION OF NOSETIP TRANSITION: MODEL REFINEMENT AND VALIDATION Final Report, 15 Jul. 1975 - 15 Jul. 1976
D. C. Wilcox and T. L. Chambers Jul. 1976 96 p refs
(Contract F44620-74-C-0048; AF Proj. 9781)
(AD-A031255; DCW-R-03-04; AFOSR-76-1112TR) Avail: NTIS HC A05/MF A01 CSCL 20/4

A set of constitutive equations suitable for predicting boundary-layer transition has been developed. The equations are an improved version of the turbulence-model equations devised by Saffman and Wilcox. Detailed study of the viscous sublayer of a turbulent boundary layer establishes suitable viscous modifications to the high-Reynolds-number form of the equations. Analysis of the sublayer also establishes boundary conditions suitable for surfaces with roughness and mass injection. Additional modifications based on linear stability theory obviate difficulties previously encountered in treating effects on transition of pressure gradient and surface heat transfer. The model accurately predicts many of the salient features of incompressible boundary-layer transition including effects of freestream turbulence intensity, width of the transition region, and transitional velocity profiles. Application to the nonequilibrium relaxation of a turbulent boundary layer passing from a rough to a smooth surface demonstrates the models ability to accurately predict surface roughness effects. Most pertinent to the overall project objectives, the model accurately simulates ground-test transition experiments on re-entry vehicle geometries, including effects of surface roughness, surface cooling, and surface mass addition.
Author (GRA)

N77-18859# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
KINETIC THEORY OF HYDRODYNAMIC FLOW
J. R. Dorfman, H. VanBeijeren, and C. F. McClure *In* Polish Acad. Sci. Arch. Mech. 1976 p 333-352 refs Sponsored in part by Navy (For primary document see N77-18853 09-70)
(Grant NSF GP-38965)
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N77-18865# Cambridge Univ. (England). Dept. of Applied Mathematics and Theoretical Physics.
ON THE AVERAGED-EQUATION APPROACH TO CONDUCTION THROUGH A SUSPENSION
D. J. Jeffrey *In* Polish Acad. Sci. Arch. Mech. 1976 p 423-429 refs (For primary document see N77-18853 09-70)
Copyright. Avail: Issuing Activity

N77-18870# California Inst. of Tech., Pasadena. Chemical Engineering.
THE EFFECTIVE CONDUCTIVITY OF DILUTE SUSPENSIONS
L. G. Leal and T. J. McMillen *In* Polish Acad. Sci. Arch. Mech. 1976 p 483-499 refs (For primary document see N77-18853 09-70)
Copyright. Avail: Issuing Activity

N77-18279# Institut Franco-Allemand de Recherches, St. Louis (France).
INTRODUCTORY LECTURE ON PARTICLE BEHAVIOUR

J. Haertig *In its* Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 1-39 refs (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

N77-18284# Imperial Coll. of Science and Technology, London (England).
THE APPLICATION OF LASER-DOPPLER ANEMOMETRY TO RECIRCULATING FLOWS
J. H. Whitelaw *In* Inst. Franco-Allemand de Rech. de Saint-Louis Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 177-187 refs (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

N77-18285# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
AN APPLICATION TO LASER VELOCIMETRY TO THE INTERPRETATION OF TURBULENT STRUCTURE
H. Doyle Thompson and Ronald D. Flack, Jr. (Va. Univ.) *In* Inst. Franco-Allemand de Rech. de Saint-Louis Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 189-231 refs (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

N77-18286# Sheffield Univ. (England). Dept. of Mechanical Engineering.
EXPERIMENTAL STUDY OF TURBULENCE IN PLANE SEPARATED FLOWS
Raymond Smyth *In* Inst. Franco-Allemand de Rech. de Saint-Louis Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 233-244 refs (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

N77-18287# Boeing Co., Seattle, Wash.
APPLICATION OF LASER VELOCIMETER FOR THE EVALUATION OF THE FLOW FIELD OF A FREE MIXER DUAL FLOW NOZZLE
F. Klujber and C. D. Simcox *In* Inst. Franco-Allemand de Rech. de Saint-Louis Proc. of the ISL/AGARD Workshop on laser anemometry 1976 p 245-267 (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

N77-18288*# Virginia Univ., Charlottesville. Dept. of Engineering Science and Systems.
MEASUREMENTS IN THE MIXING REGION OF A TURBULENT JET IN A COFLOWING AIRSTREAM
J. B. Morton, G. D. Catalano, and R. R. Humphris *In* Inst. Franco-Allemend de Rech. de Saint-Louis Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 269-297 refs (For primary document see N77-18278 09-31)
(Grants NSG-47-005-019; NSF ENG-75-22488)
Avail: NTIS HC A20/MF A01 CSCL 20D

N77-18301# Politecnico di Milano (Italy). Istituto di Macchine.
A SEMPLIFIED FORMULA FOR PARTICLE FREQUENCY RESPONSE IN TURBULENT GASEOUS FLOWS
A. Coghe and U. Ghezzi *In* Inst. Franco-Allemand de Rech. de Saint-Louis Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 617-627 refs (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N77-18417* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SPRING OPERATED ACCELERATOR AND CONSTANT FORCE SPRING MECHANISM THEREFOR Patent
George L. Shillinger, Jr., inventor (to NASA) Issued 15 Feb. 1977 10 p Filed 24 Oct. 1975 Supersedes N76-11441 (14 - 02, p 0190)
(NASA-Case-ARC-10898-1; US-Patent-4,007,623; US-Patent-Appl-SN-625732; US-Patent-Class-73-12; US-Patent-Class-73-432SD; US-Patent-Class-73-71.6) Avail: US Patent Office CSCL 14B

A spring assembly consisting of an elongate piece of flat spring material formed into a spiral configuration and a free running spool in circumscribing relation to which this spring is disposed was developed. The spring has a distal end that is externally accessible so that when the distal end is drawn along a path, the spring unwinds against a restoring force present in the portion of the spring that resides in a transition region between a relatively straight condition on the path and a fully wound condition on the spool. When the distal end is released, the distal end is accelerated toward the spool by the force existing at the transition region which force is proportional to the cross-sectional area of the spring.
Official Gazette of the U.S. Patent Office

N77-18418*# Transemantics, Inc., Washington, D.C.
TORUS GRATING SPECTROMETER
H. Greiner and E. Schaffer Washington NASA Mar. 1977 10 p refs Transl. into ENGLISH from Optik (West Ger.), v. 16, n. 6, 1959 p 351-357
(Contract NASw-2792)
(NASA-TT-F-16770) Avail: NTIS HC A02/MF A01 CSCL 14B

Calculations are given for the design of a spectrometer having fixed slits and a concave grating of toroidal surface in which the grating is rotated to vary the wavelength. Conditions are stated to obtain minimum astigmatism, and from these the most favorable ratio of the radii of curvature of the toroidal surface may be derived. The gain in radiation intensity through the exit slit, as compared with a spectrometer which uses a spherical grating, is then investigated. Author

N77-18419*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYTICAL PROCEDURE FOR EVALUATING SPECKLE-EFFECT INSTRUMENTATION
Arthur J. Decker Washington Feb. 1977 35 p refs
(NASA-TM-X-3478; E-8924) Avail: NTIS HC A03/MF A01 CSCL 14B

A general analysis suitable for developing speckle effect instruments and a simplified analysis suitable for evaluating laser speckle instrumentation are presented. The simplified analysis is summarized as a list of equations. Several sample applications are discussed. Author

N77-18420*# Jobin et Yvon S. A., Longjumeau (France).
CONTINUATION OF THE STUDY OF REFLECTING DIFFRACTION GRATING BY THE APPLICATION OF HOLOGRAPHIC TECHNIQUES
26 Jul. 1974 43 p
(Contract NASw-2664)
(NASA-CR-152446; PR-3) Avail: NTIS HC A03/MF A01 CSCL 14E

For a given wavelength, the angle of incidence for the optimum relative efficiency was sensibly the same for the various gratings independently of the Nb grooves/mm. In spite of the fact that all these gratings were blazed at the same wavelength this was not obvious a priori as the blaze angle varied from 1.71 deg for 600 gr/mm to 14.41 deg for the 5,000 gr/mm grating. Author

N77-18421# California Univ., Livermore. Lawrence Livermore Lab.
NEW APPARATUS FOR THERMOPHYSICAL MEASUREMENTS ABOVE 2500 K
J. W. Shaner, G. R. Gathers, and C. Minichino Mar. 1976 9 p refs Presented at 5th European Conf. on Thermophys. Properties of Solids at High Temp., Moscow, 18-21 May 1976

(Contract W-7405-eng-48)
(UCRL-77929; Conf-760544-1) Avail: NTIS HC A02/MF A01

An apparatus was developed to make simultaneous measurements of enthalpy, temperature, volume, and electrical resistivity on metals in the temperature range from 2500 to 8000 K and at pressures up to 1 GPa. Cylindrical samples are resistively heated by a 10-50 millisecond current pulse in a constant pressure inert gas environment. Data for the refractory transition metals Nb, Mo, Ta, and W are presented. ERA

N77-18422# National Bureau of Standards, Washington, D.C. Electronic Technology Div.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY Progress Report, 1 Jul. - 31 Dec. 1975
W. Murray Bullis Oct. 1976 90 p refs Sponsored in part by SAMSO, Navy and DNA
(ARPA Order 2397)
(PB-258555/2; NBS-SP-400-25) Avail: NTIS HC A05/MF A01 CSCL 09A

Activities directed toward the development of methods of measurement for semiconductor materials, process control, and devices are described. The emphasis is on silicon device technologies. Principal accomplishments included (1) preliminary results of a systematic study of the effects of surface preparation on spreading resistance measurements; (2) development of an optical test for surface quality of sapphire; (3) development of a basis for an exposure sensitivity specification for photoresists; and (4) development of a modular cell concept for test structure design and layout. Four-probe resistivity measurements, comparison of techniques for surface analysis, ion microprobe mass analysis, redistribution profiles, and thermally stimulated current response of interface states are stipulated. GRA

N77-18423# Raytheon Co., Waltham, Mass. Research Div.
SURFACE WAVE NARROW BAND RESONATORS Final Report, 30 Jun. 1975 - 29 Jun. 1976
F. Sandy and T. E. Parker Sep. 1976 62 p refs
(Contract DAAB07-75-C-1348; DA Proj. 1S7-62705-AH-94)
(AD-A030139; S-2065; ECOM-75-1348-F) Avail: NTIS HC A04/MF A01 CSCL 09/5

Measurements have been made on numerous types of reflective gratings to determine the phase of the reflection and to find methods of getting high reflectivity per stripe. A new form of grating consisting of gold stripes recessed in ion-etched grooves has been found to have a very high reflection coefficient per stripe. Novel fabrication techniques for this type of grating are discussed. It has been concluded that the goals of this program of very low insertion loss, high out-of-band rejection, and large (for a resonator) bandwidth cannot be achieved simultaneously with conventional SAW resonators. Therefore, a new type of device called a ring filter has been developed and studied. Like a resonator it confines virtually all of the acoustic energy with highly reflecting gratings. However, since tightly coupled transducers are used, very little energy makes more than one transit around the ring. It is therefore not truly resonant except as a degenerate case of resonance. The geometry is such, however, that the transducers cannot transmit to each other when the gratings become transparent. This provides very high out-of-band rejection without the sacrifice of other needed device characteristics as with conventional SAW resonator geometries. The properties of several ring filters, which have been built, are discussed. On LiNbO3 an insertion loss of 2.5 dB has been achieved with a 3 dB bandwidth of 1.4 percent. Out-of-band rejection is better than 60 dB. On ST-cut quartz an insertion loss of 4 dB has been obtained along with a 2.3 percent bandwidth. Again out-of-band rejection is better than 60 dB. Author (GRA)

N77-18424# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
OPTICAL MATCHED FILTERING TECHNIQUES FOR AUTOMATIC INTERROGATION OF AERIAL RECONNAISSANCE FILM Final Report
Kenneth G. Leib, Robert A. Bondurant, and Stephen Hsiao Sep. 1976 134 p refs
(Contract DAAG53-75-C-0199)
(AD-A030574; RE-524) Avail: NTIS HC A07/MF A01 CSCL 15/4

The continuing requirement for aerial reconnaissance imagery has created a need for systems to rapidly screen and interpret this film to complement the human photointerpreters handling the current work load. The Grumman developed Optical Matched Filter Image Correlation System (OMFIC) processes such imagery through holographic lens-matched filter optical memories at high speed conservatively estimated at 180 sq cm per second for 70 mm aerial reconnaissance film. To establish such a system, analyses of matched filter output sensitivities with variation in image parameters are made. The (-3 db) sensitivities determined for the M-60 target are: scale , + or - 19 percent in area about 100 percent image; contrast, imagery can have optical density range of 1 to 5 OD; resolution, equal or greater than 5 cycles per target width; and, orientation, + or - 8 degrees. These sensitivities were arrived at by independently varying each parameter. Such information is utilized in the memory requirement determination for the target of interest (M-60 tank). The data show the requirement for 23 filter positions of memory to cover a 360 degree target orientation. Interrelated parametric variations will require additional memory positions. GRA

N77-18425# Hughes Aircraft Co., Carlsbad, Calif. Industrial Products Div.
STORAGE CAMERA TUBE WITH NON-DESTRUCTIVE READOUT Final Report, 14 Feb. 1975 - 12 Apr. 1976
L. S. Yaggy Aug. 1976 52 p refs
(Contract DAAB07-75-C-1305; DA Proj. 1S7-62705-AH-94)
(AD-A030926; ECOM-75-1305-F) Avail: NTIS HC A04/MF A01 CSCL 17/2

Efforts and accomplishments are reviewed at the conclusion of a storage cameratube contract. This was a follow-on to the development started on Contract No. DAAB07-73-C-0330, which resulted in a tube capable of dual-mode operation; real-time television or storage with non-destructive readout. Performance of the resulting device approached the goals outlined in Technical Guidelines BD-2, which included mode-switching on command, useful sensitivity at 1.06 micrometer wavelength, and 6:1 zoom in the stored mode. The follow-effort was aimed primarily at increasing the quantum efficiency at 1.06 micrometer and, at the same time, realizing the resolution goal of 900 TV-lines per raster-height. A new tube was designed and fabricated to accommodate a larger diode array target having more resolution elements and a greater thickness for photon absorption. Data from resulting tubes are presented. Author (GRA)

N77-18426# Rome Research Corp., N. Y.
RECONNAISSANCE SENSOR SYSTEM EXPLOITATION Final Technical Report, May 1975 - Jun. 1976
Richard R. Petroski Griffiss AFB, N.Y. RADC Aug. 1976 50 p
(Contract F30602-75-C-0172; AF Proj. 6244)
(AD-A031024; RRC-76-1; RADC-TR-76-248) Avail: NTIS HC A03/MF A01 CSCL 15/5

The report documents several tasks accomplished under the project titled 'Reconnaissance Sensor System Exploitation'. It is intended to give a brief summary of the sensor evaluations and analyses performed under the project along with Data Base and Northeast Test Area (NETA) support provided. Other efforts, considered to be of limited interest to the reconnaissance community, are not included. GRA

N77-18427# Aeronutronic Ford Corp., Newport Beach, Calif. Industrial and Environmental Products Operations.
DEVELOPMENT OF A PROPORTIONAL SAMPLER FOR AUTOMOBILE EXHAUST EMISSIONS TESTING Final Report, Jul. 1974 - Mar. 1976
Harold J. Haskins Jun. 1976 122 p refs
(Contract EPA-68-02-1755)
(PB-258851/5; EPA-600/2-76-169) Avail: NTIS HC A06/MF A01 CSCL 14B

The development of a device that is capable of sampling gaseous emissions from automobiles is described. The device samples exhaust gases at a mass rate that is proportional to the total exhaust gas mass flow rate, which is measured using an ultrasonic vortex flowmeter. The flowmeter delivers signals, which are conditioned by process control electronics, to a sample valve. Non-standard temperature and pressure conditions at both

the vortex flowmeter and the sample valve are compensated for in the process control electronics. GRA

N77-18428# Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.
TiO2 THIN FILM: A NEW, UNCONVENTIONAL PHOTOGRAPHIC MATERIAL Interim Report
Paul D. Fleischauer and H. K. Alan Kan 10 Aug. 1976 123 p refs
(Contract F04701-75-C-0076)
(AD-A029640; TR-0076(6270-20)-4; SAMSO-TR-76-188) Avail: NTIS HC A06/MF A01 CSCL 14/5

An extensive research program concerning the photochemical reduction of silver ions on TiO2 surfaces has led to the development of a new high-resolution, moderate-speed unconventional photographic film. Image formation can be initiated by absorption of either near UV light (TiO2) or of visible light in adsorbed dye sensitizers. Primary images can be developed by means of a high-gain physical development process to produce continuous-tone images that can be read either optically or with an electron beam. Author (GRA)

N77-18280# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
DATA PROCESSING IN LASER ANEMOMETERY
Alain Boutier *In* Inst. Franco-Allemand de Rech. de Saint-Louis Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 41-53 refs (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

N77-18281# Naval Surface Weapons Center, White Oak, Md. Experimental Aerodynamics Branch.
LASER DOPPLER VELOCIMETRY TECHNIQUES IN TRANSONIC AND SUPERSONIC FLOWS: A REVIEW
William J. Yanta *In* Inst. Franco-Allemand de Rech. de Saint-Louis Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 55-117 refs (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

N77-18282# Centre d'Etudes Aerodynamiques et Thermiques, Poitiers (France).
DEVELOPMENT AND APPLICATION OF LASER ANEMOMETRY TO TURBULENT HIGH SPEED FLOWS
P. Ardonceau, F. Boue, and R. Leblanc *In* Inst. Franco-Allemand de Rech. de Saint-Louis Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 119-165 refs (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

N77-18283# United Technologies Research Center, East Hartford, Conn. Gas Dynamics Section.
LV MEASUREMENTS IN A SUPERSONIC TUNNEL
J. C. Bennett, Jr. *In* Inst. Franco-Allemand de Rech. de Saint-Louis Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 167-176 (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

N77-18290# General Electric Co., Schenectady, N.Y.
VELOCITY MEASUREMENT OF HIGH-TEMPERATURE AND HIGH-SPEED SUBSONIC JET FLOWS USING A LASER VELOCIMETER
James C. F. Wang *In* Inst. Franco-Allemand de Rech. de Saint-Louis Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 325-373 refs Sponsored by the FAA (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

N77-18296# Creare, Inc., Hanover, N.H.
SPECIAL APPLICATIONS AND NEW TECHNICAL ASPECTS OF LASER ANEMOMETRY
Peter W. Runstadler, Jr. *In* Inst. Franco-Allemand de Rech. de Saint-Louis Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 465-551 refs (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

N77-18297# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
LASER ANEMOMETRY APPLIED TO A RESEARCH COMPRESSOR
Alain Boutier, Guy Fertin, Robert Larguier, Jean Lefevre, and Alexandre DeSievers *In* Inst. Franco-Allemand de Rech. de Saint-Louis proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 553-565 refs (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

N77-18299# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
APPLICATION OF LASER ANEMOMETRY TO SHOCK TUBE STUDIES
H. Fima *In* Inst. Franco-Allemand de Rech. de Saint-Louis Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 587-601 (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

N77-18300# Technisch Physisch Dienst TNO-TH, Delft (Netherlands).
DEVELOPMENT OF A ROTATING GRATING AND ITS USE IN LASER VELOCIMETRY
J. Oldengarm, A. H. VanKrieken, and H. J. Raterink *In* Inst. Franco-Allemand de Rech. de Saint-Louis Proc. of the ISL/AGARD Workshop on Laser Anemometry 1976 p 603-615 refs (For primary document see N77-18278 09-31)
Avail: NTIS HC A20/MF A01

36 LASERS AND MASERS

Includes parametric amplifiers.

N77-18429*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IN-SITU LASER RETORTING OF OIL SHALE Patent Application
Harvey S. Bloomfield, inventor (to NASA) Filed 28 Jan. 1977 15 p
(NASA-Case-LEW-12217-1; US-Patent-Appl-SN-763753) Avail: NTIS HC A02/MF A01 CSCL 20E

Oil shale formations were retorted in-situ and gaseous hydrocarbon products recovered by drilling two or more wells into an oil shale formation. After fracturing a region of oil shale formation by directing a high energy laser beam into one of the wells and focussing the laser beam into a region of oil shale formation from a laser optical system, compressed gas was forced into the well which supports combustion in the flame front ignited by laser beam, thereby retorting the oil shale and recovering gaseous hydrocarbon products which permeate through the fractured oil shale from one of the auxiliary wells. Author

N77-18430# California Univ., Livermore. Lawrence Livermore Lab.
FOCUSING LENSES FOR THE 20-BEAM FUSION LASER, SHIVA
William C. ONeal 18 May 1976 34 p refs Presented at 1976 IEEE/OSA Conf. on Laser and Electro-Opt. Systems, San Diego, Calif., 25-27 May 1976
(Contract W-7405-eng-48)
(UCRL-77700; Conf-760513-8) Avail: NTIS HC A03/MF A01

The focus lens design for the 20-beam laser fusion facility involves considerations of uniform and normal pellet illumination. The resulting requirements dictate tailored beam intensity profiles and vacuum-loaded thin lenses. ERA

N77-18431# Institut Franco-Allemand de Recherches, St. Louis (France).
LASER INTERFEROMETER WITH PHASE COMPENSATION [LASERINTERFEROMETER MIT PHASENNACHFUEHRUNG]
G. Smeets and A. George 5 Dec. 1975 41 p refs In GERMAN
(ISL-R-136/75) Avail: NTIS HC A03/MF A01

A method for phase compensation of laser interferometers is described which allows applying methods used in laser

differential interferometry to other types of interferometers, since a high mechanical and thermal stability is no longer necessary. The electrically controlled compensator, placed in the optical path of a dual beam laser interferometer, can compensate for any variation in the path due to the phenomenon under study. The voltage needed for compensation is thus proportional to the variation of the optical path, resulting in an analog signal following the variations even over many wavelengths. First measurements are described, and possibilities for application to a new type of Doppler interferometer are examined. ESA

N77-18432# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany). Inst. fuer Chemische Raketenantriebe.

GASDYNAMIC CO2 LASERS. CHEMICAL METHODS FOR PRODUCING THE WORKING GAS

Robert Schmucker and Hans G. Ruppik 21 Sep. 1976 40 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-361)

(DLR-FB-76-49) Avail: NTIS HC A03/MF A01; DFVLR, Cologne, DM 19.40

A high chamber temperature and low CO2 and H2O content are necessary to improve the performance of gasdynamic CO2 lasers. These conditions may be attained by the combustion of appropriate reactants. Using carbon, hydrogen, nitrogen, and oxygen as reference substances, the possibility of increasing the temperature by the use of reactants with higher heats of formation is treated, and the consequent improvement in performance caused by the addition of high temperature nitrogen is discussed. Author (ESA)

N77-18433# European Space Agency, Paris (France).

GASDYNAMIC CO2 LASER. METHODS OF CHEMICAL PRODUCTION OF THE WORKING GASES

Robert Schmucker et al Jan. 1977 33 p refs Transl. into ENGLISH of 'Gasdynamische CO2-Laser. Methoden zuer chem. Erzeugung des Arbeitsgases', DFVLR, Hardthausen, West. Ger. Report DLR-FB-76-49, 21 Sep. 1976 Original report in German previously announced as ESA-98419 Original German report available from DFVLR, Cologne DM 19.40

(ESA-TT-361; DLR-FB-76-49) Avail: NTIS HC A03/MF A01

A high chamber temperature and low CO2 and H2O content are necessary to improve the performance of gasdynamic CO2 lasers. These conditions may be attained by the combustion of appropriate reactants. Using carbon, hydrogen, nitrogen, and oxygen as reference substances, the possibility of increasing the temperature by the use of reactants with higher heats of formation is treated, and the consequent improvement in performance caused by the addition of high temperature nitrogen is discussed. Author (ESA)

N77-18434# Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.

A SYSTEM EMPLOYING LASER HEATING FOR THE MEASUREMENT OF HIGH-TEMPERATURE THERMAL PROPERTIES OVER A WIDE PRESSURE RANGE Interim Report

A. Whittaker, Kintner Greenville, L. S. Nelson (Sandia Corp., Albuquerque, N. Mex.), and N. Richardson (Sandia Corp., Albuquerque, N. Mex.) 7 Jul. 1976 39 p refs

(Contract F04701-75-C-0076)

(AD-A029459; TR-0076(6250-11)-2; SAMSO-TR-76-133) Avail: NTIS HC A03/MF A01 CSCL 11/2

An equipment system is described that can be used to obtain high-temperature physical property data on refractory materials by means of laser heating. Properties that can be measured are: vapor pressure of solid and liquid phases; relative rate of vaporization; and emission spectra from solid and vapor phases. Solid phases can be studied by splat cooling of the liquid and quench cooling of the solid and vapor. Temperature can be measured both pyrometrically and spectroscopically. In addition, the effects produced by heating a material in an atmosphere of controlled composition and pressure can be studied. The equipment system described here was designed to obtain data on the phase behavior of carbon in the 3500 to 4700 K temperature range, a temperature range for which there is no material that can be used to contain carbon to measure vapor pressure, phase transitions, and melting point by the conventional methods. The CO2 laser was used for heating. GRA

N77-18435# Memphis State Univ., Tenn. Dept. of Electrical Engineering.

OPTICAL TECHNIQUES FOR SURFACE CHARACTERIZATION Final Report, 15 Oct. 1975 - 14 Jul. 1976

Carl E. Halford and Charles W. Bray Aug. 1976 37 p refs (Contract DAAG29-76-G-0074)

(AD-A031076; ARO-13579.1-R-P) Avail: NTIS HC A03/MF A01 CSCL 20/6

The available statistical analyses of laser speckle from smooth surfaces have been extended to account for the effect of anisotropic surfaces on the contrast and on the autocorrelation function. Experimental results are presented for comparison with the theoretical results. For rough surfaces, an experiment is proposed for remotely determining surface roughness by using two different illuminating angles. A significant aspect of the procedure is that photographic processing has been removed from the experiment so that the technique is of interest in radar applications. An extensive literature survey of methods for measuring correlation length is reported. The various techniques are classified into three categories, profilometric, optical, and photomicrographic. The most promising procedures are discussed and two techniques are recommended for laser radar research. Author (GRA)

N77-18436# Hughes Research Labs., Malibu, Calif.

COAT/TARGET-SIGNATURE INTERACTIONS Final Technical Report, 1 Aug. 1975 - 1 Feb. 1976

Melvin E. Pedinoff, Stan A. Kokorowski, and James E. Pearson Griffiss AFB, N. Y. RADC Jul. 1976 91 p ref

(Contract F30602-76-C-0021; ARPA Order 1279; AF Proj. 1279)

(AD-A030055; RADC-TR-76-230) Avail: NTIS HC A05/MF A01 CSCL 20/6

Amplitude modulation effects which can occur when target return speckle patterns move by a receiver aperture, have been studied in adaptive optical systems that use multidither coherent optical adaptive techniques (COAT). Good agreement is found between experimental, analytical, and computer simulation studies made to characterize the degree to which COAT systems can be affected by speckle. Both experimental and computer simulation results show that in the worst-case, the convergence-level (Strehl ratio) of an 18-element COAT system is reduced to 30% of that obtained with no spurious speckle modulations. Calculations using an analysis developed here, predict an average covergence level of 0.18, in reasonable agreement with experiment, but somewhat pessimistic. In the presence of speckle noise, the COAT system convergence rate is unaffected as is the convergence level until it reaches the 'average' level that is set by the speckle noise. The convergence level then oscillates in a random fashion between well-defined maximum and minimum values. For any given multidither COAT system, we have developed analytical and computer simulation tools that can accurately predict the average convergence level and oscillation extremes once the power spectrum of speckle-induced modulations is known. We have observed that reducing the servo gain (bandwidth) reduces the effect of speckle modulations nearly to zero, but at the cost of increased convergence time. GRA

N77-18437# Rome Air Development Center, Griffiss AFB, N.Y.

AN INVESTIGATION OF THE POSSIBLE APPLICATION OF LASER TRIMMING TO ACOUSTICAL TRANSDUCERS

A. Hordvik Jul. 1976 13 p refs

(AF Proj. 5634)

(AD-A030602; RADC-TR-76-237) Avail: NTIS HC A02/MF A01 CSCL 09/1

An experimental investigation has been made of the possibility of using a laser to remove shorts and to trim lengths of high frequency interdigital transducers. Such a laser is required to have the capability of removing pieces of the metallic electrodes in increments of 1 sq micron or less. The experiment was performed on a 1,000 A thick aluminum layer on top of a 300 A thick chromium layer on a quartz substrate which is a typical coating used for making interdigital transducers. Using a doubled Nd:YAG laser (wavelength 0.532 micron) with a pulse of about 100 nsec it was found that holes of area 1 sq micro

could be punched with a pulse energy of about 1 microjoule.
Author (GRA)

N77-18438# Army Environmental Hygiene Agency, Aberdeen Proving Ground, Md.
EVALUATION OF TRAINING PROBLEMS WITH TACTICAL LASERS, JANUARY - JULY 1976 Nonionizing Radiation Protection Special Study
David H. Sliney and James K. Franks Jul. 1976 17 p refs
(AD-A030039; USAEH-42-058-76) Avail: NTIS HC A02/MF A01 CSCL 13/12

A special study of the particular problems associated with the training operations of tactical fire control lasers was performed by this Agency during the period January-July 1976. The feasibility of using a retroreflector equipped target and filtering the output of the AN/VSS-1 laser rangefinder (LRF) was studied for use with laser rangefinders. It was concluded that at ranges of 200-300 m, a 90-percent probability of successful ranging existed when retroreflectors were used. For ranges from 300 m out to 1 k, the probability decreased to 75 percent. From 2000-3000 m, the probability further decreased to approximately 20 percent for successful ranging. Author (GRA)

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N77-18439 Societe Francaise d'Aerothermodynamique, Rueil-Malmaison (France).
RETURN CHANNEL FOR GASEOUS FLOW AT SONIC VELOCITY Final Report [ETUDE D'UN CANAL DE RETOUR POUR FLUX GAZEUX A VITESSE SONIQUE]
Jan. 1976 33 p refs In FRENCH
(Contract DGRST-73-7-1768)
Avail: Issuing Activity

A study was carried out to realize a return channel for centrifugal compressors with radial blades and rotor diffusers. The need to improve the pressure characteristics of the machine at the zone between stages, defined by operating conditions, leads to action on the work supplied by each wheel by a certain degree of prerotation, and to adapting the correction blades, placed at the exit of the wheel, to the flow characteristics at that point. The return channel constructed, containing a regulator, allows fulfilling these two functions. ESA

N77-18440 Centre Technique de l'Industrie Horlogere, Besancon (France). Lab. Materiaux.
LUBRICATION OF MICROMECHANISMS UNDER SEVERE CONDITIONS AND APPLICATION OF SILICONE FLUIDS WITH LOW SURFACE TENSION Final Report [LUBRIFICATION DE MICROMECANISMES FONCTIONNANT EN CONDITIONS DIFFICILES ET MISE EN OEUVRE DE FLUIDES SILICONES A BASSE TENSION SUPERFICIELLE]
Michel Massin Dec. 1975 57 p refs In FRENCH
(Contract DGRST-74-7-0687)
Avail: Issuing Activity

Several silicone fluids were investigated for use as lubricant in micromechanisms. A systematic study is presented on their properties and behavior in contact with solid surfaces, and also on the lubrication properties and conditions of utilization as lubricant. Two applications are discussed: lubrication of aircraft instruments and of clocks. ESA

N77-18441 Institut National des Sciences Appliquees, Villeurbanne (France). Lab. de Mecanique des Contacts.
HYDRODYNAMIC BEARINGS IN THE NONLAMINAR REGIME. OIL SUPPLY TO HERTZIAN CONTACTS Final Report [PALIERS HYDRODYNAMIQUES EN REGIME NON LAMINAIRE. ALIMENTATION EN HUILE DES CONTACTS HERTZIENS]
D. Berthe, J. Frene, and M. Godet Dec. 1975 60 p refs In FRENCH
(Contract DGRST-72-7-0721)
Avail: Issuing Activity

A theoretical study is presented on journal bearings in the nonlaminar regime. A critical survey is made of existing turbulent mixing flow theories, and a simple calculation method is presented. Results are compared with Constantinescu's theory, leading to satisfactory agreement. An experimental study was made of Hertzian contacts. This study shows that the surface roughness may lead to lubrication problems (film instability or cavitation).
ESA

N77-18442*# Martin Marietta Corp., Denver, Colo.
FLIGHT REPRESENTATIVE POSITIVE ISOLATION DISCONNECT Final Report
Arthur A. Rosener and Thomas G. Jonkoniec Jan. 1977 82 p
(Contract NAS9-14926)
(NASA-CR-151184; MCR-77-1) Avail: NTIS HC A05/MF A01 CSCL 13E

Resolutions were developed for each problem encountered and a tradeoff analysis was performed to select a final configuration for a flight representative PID (Positive Isolation Disconnect) that is reduced in size and comparable in weight and pressure drop to the developmental PID. A 6.35 mm (1/4-inch) line size PID was fabricated and tested. The flight representative PID consists of two coupled disconnect halves, each capable of fluid isolation with essentially zero clearance between them for zero leakage upon disconnect half disengagement. An interlocking foolproofing technique prevents uncoupling of disconnect halves prior to fluid isolation. Future development efforts for the Space Shuttle subsystems that would benefit from the use of the positive isolation disconnect are also recommended. Customary units were utilized for principal measurements and calculations with conversion factors being inserted in equations to convert the results to the international system of units. Author

N77-18443*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CATALYTIC COMBUSTION FOR THE AUTOMOTIVE GAS TURBINE ENGINE
David N. Anderson, Robert R. Tacina, and Thaddeus S. Mroz 1977 23 p refs Proposed for presentation at the 4th Intern. Symp. on Automotive Propulsion Systems, Washington, D. C., 17-22 Apr. 1977; sponsored by NATO
(NASA-TM-X-73589) Avail: NTIS HC A02/MF A01 CSCL 21A

Fuel injectors to provide a premixed prevaporized fuel-air mixture are studied. An evaluation of commercial catalysts was performed as part of a program leading to the demonstration of a low emissions combustor for an automotive gas turbine engine. At an inlet temperature of 800 K, a pressure of 500,000 Pa and a velocity of 20 m/s a multiple-jet injector produced less than + or - 10 percent variation in Jet-A fuel-air ratio and 100 percent varporization with less than 0.5 percent pressure drop. Fifteen catalytic reactors were tested with propane fuel at an inlet temperature of 800 K, a pressure of 300,000 Pa and inlet velocities of 10 to 25 m/s. Seven of the reactors had less than 2 percent pressure drop while meeting emissions goals of 13.6 gCO/kg fuel and 1.64 gHC/kg fuel at the velocities and exit temperatures required for operation in an automotive gas turbine engine. NO sub x emissions at all conditions were less than 0.5 ppm. All tests were performed with steady state conditions. Author

N77-18444# Oak Ridge Y-12 Plant, Tenn.
WELDING COPPER TO ITSELF AND TO STEEL
P. W. Turner, W. C. Collins, D. Gillespie, Jr., R. L. McIlwain, and L. C. Watson 1976 35 p refs Presented at the 5th Reg. Seminar on Pract. Appl. in Manufacturing, Gatlinburg, Tenn., 23 Apr. 1976
(Contract W-7405-eng-26)
(Y-DA-6706; Conf-760468-2) Avail: NTIS HC A03/MF A01

Five applications are described in which oxygen-free copper was joined either to itself or to steel. Braze welding and the use of transition welds were utilized on dissimilar metal joints. Welding was performed with either the gas tungsten arc process or with the gas metal arc process. Selection of copper for welded structures and the welding difficulties stemming from the high thermal diffusivity of copper were considered briefly. Descriptions of welded hardware are provided that covered the design of welds on water-cooled arc-melting crucibles, NaK-cooled casting crucibles, components for radio-frequency cyclotrons, and

steel valve parts subjected to metal-to-metal wear in a corrosive environment. ERA

N77-18445# Union Carbide Corp., Oak Ridge, Tenn.
ESTIMATING HEAT-TO-HEAT VARIATION IN MECHANICAL PROPERTIES FROM A STATISTICIAN'S POINT OF VIEW
T. L. Hebble 1976 29 p refs Presented at the Intern. Joint Pressure Vessels and Piping and Petrol. Mech. Eng. Conf., Mexico City, 19 Sep. 1976
(Contract W-7405-eng-26)
(CONF-760905-6) Avail: NTIS HC A03/MF A01

A statistical technique known as analysis of variance (ANOVA) is used to estimate the variance and standard deviation of differences among heats. The total variation of a collection of observations and how an ANOVA can be used to partition the total variation into its sources are discussed. Then, the ANOVA is adapted to published Japanese data indicating how to estimate heat-to-heat variation. Finally, numerical results are computed for several tensile and creep properties. ERA

N77-18446# Georgia Inst. for Research, Atlanta.
SINGLE WHEEL GAS TURBINE TOPPING UNIT FOR COAL BURNING POWER PLANTS Progress Report
T. W. Jackson and G. T. Colwell 15 Mar. 1976 47 p refs
(Contract E(40-1)-4959)
(ORO-4959-1) Avail: NTIS HC A03/MF A01

The laminar steady flow of air through moving narrow deep circumferential grooves on a rotor was studied. Fluid enters the moving grooves from a stationary inlet nozzle with uniform velocity and exits into a stationary diffuser after approximately 150 degrees of rotation. Three-dimensional developing velocity profiles and pressure distributions are presented for a variety of operating conditions. Computed overall head-flow characteristics are found to be in relatively close agreement with the simple Couette model where both walls are taken to be moving at the same rate and in the same direction. ERA

N77-18447# Sandia Labs., Albuquerque, N.Mex.
PARALLEL GAP WELDING TO THICK FILM METALLIZATION
D. R. Johnson and R. E. Knutson 1976 8 p refs Presented at the Electron. Components Conf., San Francisco, Apr. 1976 Sponsored by ERDA
(SAND-76-5119; Conf-760414-2) Avail: NTIS HC A02/MF A01

The parallel gap welding response of a series of gold and platinum-gold thick film conductor materials which were subjected to various peak temperature/belt speed firing profiles was studied. The parallel gap welding was conducted using a variety of weld voltage/pulse duration settings and a nominal 0.05 millimeter thick by 0.38 millimeter wide pure gold ribbon. Evaluation of the welds was determined through a 90 deg peel test. It was concluded that parallel gap welding is a viable approach to gold ribbon interconnection to thick film. In general, thicker fired films respond better to parallel gap welding. Sensitivity to firing profile, as reflected by parallel gap weld strength, is a characteristic of each specific thick film material which must be determined and properly optimized. Sensitivity to weld parameters is a characteristic of each specific material and should be optimized with firing profile. The pure gold conductor materials are not as satisfactory as platinum-gold conductors for parallel gap welding. ERA

N77-18448# Battelle Pacific Northwest Labs., Richland, Wash.
FLYWHEEL-HEAT ENGINE POWER FOR AN ENERGY-ECONOMIC PERSONAL VEHICLE
W. V. Loscutoff Mar. 1976 48 p refs
(Contract E(45-1)-1830)
(BNWL-2006) Avail: NTIS HC A03/MF A01

A technical and fuel economy assessment of a small personal vehicle powered by a hybrid flywheel/heat engine drive system is presented. Technical evaluations indicate that a flywheel/heat engine system based on improved materials technology could serve as a practical vehicle drive. While somewhat limited in performance, the proposed system could produce significant improvements in fuel consumption rates. Technological advancements in materials and power transmission systems would make flywheel/heat engine systems even more attractive. ERA

N77-18449# Ford Motor Co., Dearborn, Mich. New Concepts Research Dept.
FORD/ERDA CONTINUOUSLY VARIABLE TRANSMISSION. PHASE 1: TRANSMISSION DESIGN Progress Report, 1 Jan. - 31 Mar. 1976
T. R. Stockton 1976 10 p
(Contract E(11-1)-2674)
(COO-2674-9; PR-9) Avail: NTIS HC A02/MF A01

Progress is reported for a research program to analyze and design a Forster traction drive infinitely variable transmission for improving passenger car fuel economy. Many disc configurations were analyzed using a finite element analysis computer program, and performance and fuel economy estimates were made from a simulation model. An initial transmission layout design was completed, and test rig components were inspected and assembled. Author (ERA)

N77-18450# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
EFFECT OF STRESS RELIEF PARAMETERS ON THE MECHANICAL PROPERTIES OF PRESSURE VESSEL STEELS AND WELDMENTS
D. A. Canonico and W. J. Stelzman 1976 18 p Presented at Japan Ind. Planning Assoc. Symp., Tokyo, 17 May 1976 Sponsored by ERDA
(Conf-760547-2) Avail: NTIS HC A02/MF A01

Post weld heat treatments of thick-section steel for nuclear pressure vessels are discussed. The discussion is in the form of a lecture and summarized by noting that the ASME code, in particular Section III, Division 1, imposes a weld heat treatment requirement on pressure vessels fabricated from low alloy high strength steels. The code permits a holding temperature range, the high side of which could result in poorer toughness properties. Long times in excess of 100 hours and/or high temperatures, 649 C can result in a decrease in the upper shelf energy. ERA

N77-18451# Mound Lab., Miamisburg, Ohio.
MC2990: DEVELOPMENT OF A HELIUM LEAK TIGHT HEADER
Frank W. Weyler and Alvan C. Taulbee 30 Jul. 1976 11 p
(Contract E(33-1)-GEN-53)
(MLM-2280) Avail: NTIS HC A02/MF A01

All of the development efforts expended on establishing a fabrication process for the MC2990 sealed header are described. Effects of molding pressure and temperature are discussed. Helium leak test data are presented for various header configurations. The header molding process as developed in this effort resulted in an acceptance rate greater than 90 percent. ERA

N77-18452# Technische Universitaet, Munich (West Germany). Inst. fuer Ergonomie.
THE DISPLAY OF BRAKING DISTANCE IN A ROAD VEHICLE [UNTERSUCHUNG UEBER DIE ANZEIGE DES BREMSWEGES IM KRAFTFAHRZEUG]
Heiner Bubb Bonn DOKZENTBw 1976 172 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(BMVg-FBWT-76-7) Avail: NTIS HC A08/MF A01; DOKZENTBw DM 40

An ergonomic analysis of the driver-vehicle-system demonstrates the fact that it is possible to optimize the choice of the driving speed as soon as the driver is informed about the braking distance of his vehicle. For this purpose it is necessary to calculate the friction coefficient describing the tire-road contact while driving. The braking distance can then be displayed as functions of the velocity of the vehicle. The friction coefficient is calculated by measuring the slip of the driving wheels in relation to the actual driving torque, acceleration, and driving speed. A formula describing the relations between these parameters was developed and confirmed by driving experiments. Various possibilities of displaying the braking distance are discussed in detail.
Author (ESA)

N77-18453# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
BRAKE FLUID STROKING TESTS USING A TANDEM (DUAL-CHAMBER) MASTER CYLINDER Final Report
James H. Conley Jul. 1976 23 p

(DA Proj. 1T6-62611-AH-69)
(AD-A030522; USAMERDC-2185) Avail: NTIS HC A02/MF A01 CSCL 11/8

The object of the study was to determine the feasibility of replacing the presently used single-chamber master cylinder with a dual-chamber master cylinder in brake fluid stroking tests. Dual-chamber master cylinders were obtained from two sources and were subjected to stroking tests. The SAE compatibility fluid was used in both the drum-and-shoe system and the SAE stroking fixture system. In all tests, malfunctions were attributed to the heat-sensitive quality of the SBR master cylinder rubber cups. Excessive pressure loss was noted when the test temperature was reached. Results of this study indicate clearly that the dual-chamber master cylinder should not be used in the standard brake fluid stroking test until brake cups which are less heat sensitive are developed. Author (GRA)

N77-18454# Battelle Columbus Labs., Ohio.
EXPLORATORY DEVELOPMENT OF DESIGN DATA ON JOINTS USING FATIGUE-IMPROVEMENT FASTENERS Final Report, 1 Jun. 1973 - 2 Feb. 1976
Stephen C. Ford Wright-Patterson AFB, Ohio AFML May 1976 203 p refs
(Contract F33615-73-C-5111; AF Proj. 7381)
(AD-A030275; AFML-TR-76-52) Avail: NTIS HC A10/MF A01 CSCL 13/5

This report presents fatigue design data on joints using fatigue-improvement fasteners. The major emphasis is placed upon low-load transfer specimens made of 7075-T73 and T7351 aluminum, assembled with PH13-8Mo and Ti-6Al-4V fasteners using the TaperLok, HiTigue, and split-sleeve mandrelized hole-fastening systems. The study revealed that the fatigue properties of fastener joints with mandrelized holes were similar to those of fastener joints with the TaperLok and HiTigue fastener systems. A method of condensed data presentation in MILHDBK-5 is proposed along with data requirements for future programs. GRA

N77-18455# Rensselaer Polytechnic Inst., Troy, N.Y.
THE PREVENTION OF HYDROGEN-INDUCED CRACKING IN HY-130 WELDMENTS Progress Report, period ending 1 Jul. 1976
1976 16 p refs
(Contract N00014-75-C-0944; NR Proj. 031-780)
(AD-A029658) Avail: NTIS HC A02/MF A01 CSCL 13/5

The present research has the following objectives: (1) To evaluate the interrelationship among the mechanical, metallurgical, and chemical factors responsible for hydrogen-induced cracking in HY-130 steel weldments using the Augmented Strain Cracking Test. (2) To determine the effect of preheat and interpass temperatures and times on level of hydrogen retained. (3) To study, with the aid of acoustic emission technology and both electron and optical microscopy, the mechanisms for nucleation and propagation of hydrogen-induced cracks. (4) To recommend soundly based yet practical procedures for eliminating hydrogen-induced cracking in HY-130 weldments. Testing performed to date has been restricted to a constant augmented strain of 0.5%. This level of strain produces a stress in the outer fibers slightly in excess of the yield stress. Effects of the following are discussed: Hydrogen Content; Preheat; Postheat; Hydrogen Distribution Experiments. GRA

N77-18456# Mechanical Technology, Inc., Latham, N.Y.
DESIGN AND EVALUATION OF BALL AND ROLLER BEARING ANALYZERS Final Report, 26 Jun. 1974 - 8 Feb. 1976
Leo W. Winn Aug. 1976 40 p refs
(Contract DAAG46-74-C-0125)
(AD-A030536; MTI-76TR27; AMMRC-CTR-76-2?) Avail: NTIS HC A03/MF A01 CSCL 13/9

This report presents a description of the design and evaluation procedure employed in the construction of a ball bearing and roller bearing analyzer. The analyzers' capability to differentiate between acceptable and rejectable bearings has been demonstrated on a pilot sample. The results obtained on the analyzer were in excellent agreement with results of manual bearing inspection. Author (GRA)

N77-18457# Brush Wellman, Inc., Cleveland, Ohio.
PRODUCTION ENGINEERING MEASURES TO MANUFACTURE SUPER FINE FINISH BERYLLIA Quarterly Progress Report, 1 Apr. - 30 Jun. 1976
K. A. Walsh 10 Jul. 1976 20 p refs
(Contract DAAB07-74-C-0606)
(AD-A029502; BW-TR-580; QPR-7) Avail: NTIS HC A02/MF A01 CSCL 13/8

The First Article units and a revised Test Report were submitted and accepted by the government. Pilot Run demonstration of the capability of progressive polishing to produce at least 1000 substrates per week of each of three sizes of super fine finish beryllia was completed using installed manufacturing-scale equipment. Working surfaces with 3 to 3.5 microinches surface finish resulted. The input substrates were commercially available 99.5% BeO parts of 1.0 inch by 1.0 inch or 2.0 inch by 2.0 inch dimensions. Author (GRA)

N77-18458# Iowa Univ., Iowa City. Div. of Materials Engineering.
MECHANICAL DESIGN OPTIMIZATION WITH TRANSIENT DYNAMIC RESPONSE Ph.D. Thesis. Interim Technical Report, Sep. 1975 - Apr. 1976
M. H. Hsiao, E. J. Haug, Jr., and J. S. Arora Apr. 1976 111 p refs
(Contract DAAA09-76-C-2013)
(AD-A029677; ITR-23) Avail: NTIS HC A06/MF A01 CSCL 13/6

In this report a technique for mechanical design optimization with constraints on transient dynamic response is developed through application of optimal design theory and functional analysis. Cost and constraint functions involving the state variables, design parameters, and environmental parameters are first formulated as extreme value functionals. Three equivalent problem formulations are employed to reduce the extreme value functionals to more elementary functional forms. A generalized steepest descent method is used to solve the reduced optimization problem. Through solution of a test problem, the superior equivalent treatment is selected. Several mechanical system problems involving a family of input or environmental excitation functions are solved to illustrate the technique. GRA

N77-18459# AiResearch Mfg. Co., Phoenix, Ariz.
THREE-PHASE PROGRAM TO DEFINE REQUIREMENTS FOR OPERATION OF FLUIDICS ON COMPRESSOR BLEED AIR. (DEVELOPMENT OF A COMPRESSOR BLEED AIR SIMULATOR FOR EVALUATION OF FILTRATION EQUIPMENT) Final Report, 18 Jun. 1974 - 26 Mar. 1976
Ray P. Martin, James A. Denneny, Trevor G. Sutton, and H. R. Gamble 2 Aug. 1976 221 p
(Contract N62269-74-C-0647)
(AD-A029986; AiResearch-76-411328) Avail: NTIS HC A10/MF A01 CSCL 20/4

A means of determining the ability of fluidics and filter systems to resist contamination when operating on gas turbine bleed air was required. A previous program determined the typical contaminants present in bleed air. This program determined the best approach to simulation and includes design and fabrication of a simulator which may be used to determine life and maintainability requirements for control elements and filters using compressor bleed air as the working fluid. Author (GRA)

N77-18460# Harry Diamond Labs., Adelphi, Md.
SELECTIVE ANALYSIS FOR CARBON MONOXIDE, HYDROCARBONS, AND NITRIC OXIDE IN A STREAM OF INTERNAL COMBUSTION ENGINE EXHAUST GASES: A LITERATURE SURVEY
Peter C. Sheffer and J. Michael Boyd Aug. 1976 26 p refs
(DA Proj. 1T1-61101-A-91A)
(AD-A029369; HDL-TM-76-15) Avail: NTIS HC A03/MF A01 CSCL 21/7

This paper reports a literature survey on the methods of selective analysis for the exhaust gases including carbon monoxide, hydrocarbons, and nitric oxide. Particular interest is paid to those methods that have the potential to be adapted to the design of a processor for the analyzer. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N77-18461*# National Bureau of Standards, Washington, D.C.
ULTRASONIC REFERENCE BLOCKS AND CHARACTERIZED FATIGUE CRACKS Final Report
Donald G. Eitzen and Daniel J. Chwirut 1976 24 p refs Repr. from Proceedings of ARPA/AFML Review of Quantitative Non Destructive Evaluation, Thousand Oaks, Calif., 15-17 Jul. 1975, Technical Report AFML-TR-75-212, Jan. 1976 p 107-127 Sponsored in part by NASA and Army Materials and Mechanics Res. Center, Watertown, Mass.
(Contract F33615-74-M-6752)
(NASA-CR-149654; PB-258012/4) Avail: NTIS HC A02/MF A01 CSCL 14B

Several possible methods of providing improved standards are suggested. The fatigue loading program is controlled to produce nominally identical cracks. Six different techniques for measuring the physical characteristics of the cracks were evaluated which show good correlation. Techniques which have been developed for the calibration of ultrasonic and acoustic emission transducers are noted. GRA

N77-18462# Advisory Group for Aerospace Research and Development, Paris (France).
SOME ENGINEERING PROBLEMS IN THE ROYAL AIR FORCE
H. Durkin (Royal Air Force, London) Feb. 1977 11 p
(AGARD-R-653; ISBN-92-835-1239-2) Avail: NTIS HC A02/MF A01

The current problems of the RAF related to the structural and materials areas are described, and the improvements sought in the fields of reliability, maintainability, structural integrity, design, inspection, corrosion and battle damage are indicated. Author

N77-18463# European Space Research and Technology Center, Noordwijk (Netherlands). Product Assurance Div.
GUIDELINES FOR THE CONTROL OF LIMITED-LIFE MATERIALS
Paris ESA 1 Dec. 1976 16 p
(ESA-PSS-28/QRM-22-ESTEC-Iss-1) Avail: NTIS HC A02/MF A01

Procedures are given that must be observed when limited life materials are employed in the construction of ESA spacecraft. Limited life materials currently used in spacecraft hardware are paints, coatings, adhesives, potting compounds, prepegs, etc. Their useful life is given in manufacturers' data sheets under the heading shelf life, where constraints on storage conditions are likewise often stated. ESA

N77-18464# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.
NONDESTRUCTIVE MEASUREMENTS: HOW GOOD ARE THEY Final Report
Harold Berger 1976 10 p refs Repr. from Mater. Eval., v. 34, no. 1, Jan. 1976 10 p
(PB-257812/8) Avail: NTIS HC A02/MF A01 CSCL 14B

The nondestructive evaluation measurement situation is compared to measurements being made in clinical chemistry, where an improved measurement capability was brought about through the efforts of the professionals in that field, and the development of standard reference materials and measurement methods of known accuracy. The NDE community is called upon to take similar steps and contribute to the needs for improved NDE measurements and standards. GRA

N77-18465# Stanford Research Inst., Menlo Park, Calif.
REACTOR-COMPONENT INSPECTION WITH COMPUTERIZED TOMOGRAPHY Final Report
David G. Falconer and Duane C. Gates Jul. 1976 94 p Sponsored by Elec. Power Res. Inst.
(Proj. RP-610-1)
(PB-257564/5; EPRI-NP-213) Avail: NTIS HC A05/MF A01 CSCL 18J

The contract work reported examined the technical feasibility of inspecting reactor components (especially pipe welds and fuel rods) with this imaging technique. Laboratory experiments, computer simulations, and engineering analyses were used to determine the technical, logistic, and economic attractiveness of the inspection procedure. The research effort suggests that computerized tomography can locate, size, and analyze small (1%) flaws in reactor piping and fuel rods with great reliability. Because the tomographic technique produces television-type images of the reactor component, both visual and automatic flaw detections are possible. GRA

N77-18466# Naval Aviation Integrated Logistic Support Center, Patuxent River, Md.
FEASIBILITY OF PREDICTING OPERATIONAL REMOVALS OR FAILURES OF NEW AVIONIC EQUIPMENT (MTBR TRACKING OF S-3A AVIONICS) Final Report, Jun. 1973 - Jun. 1976
R. R. Boyce and R. C. Trakas 15 Jun. 1976 81 p
(AD-A030317; NAILSC-300-7624) Avail: NTIS HC A05/MF A01 CSCL 09/3

Comparisons were made to determine the feasibility of incorporating a standardized procedure to provide reasonably accurate estimates of removals or failures and provisioning factors for avionics equipment. Three prediction methods were used to estimate the number of removals or failures to be experienced by five avionic systems on the S-3A aircraft during a period of 13 calendar months (9002 flight hours). Predicted values of removals or failures were compared with observed values reported in the Naval Maintenance and Material Management Reporting System. GRA

N77-18467# Washington State Univ., Pullman. Dept. of Pure and Applied Mathematics.
A CONFRONTATION OF MATHEMATICAL MODELS FOR FATIGUE LIFE WITH ACTUAL SERVICE DATA Final Report, 15 Sep. 1974 - 15 Sep. 1975
Sam C. Saunders Jun. 1976 34 p refs
(Contract F33615-73-C-4016; AF Proj. 7071)
(AD-A030018; AFFDL-TR-76-47) Avail: NTIS HC A03/MF A01 CSCL 01/3

From a collection of over a thousand different groups of qualified aluminum fatigue data, an empiric distribution is obtained which can serve as a standard for comparison of various mathematical models for fatigue. On this basis several commonly used parametric models, as well as some mathematical suppositions, can be discarded if good predications are desired of the earliest fatigue failures. One of the models not disqualified, which contains sufficient flexibility to fit the actual data, is a distribution of the log-life with three parameters, namely, location, scale and flexure. Because maximum likelihood estimation of all three parameters cannot be accomplished simultaneously, the location parameter is posited as being calculated on the basis of a cumulative damage rule known a priori while the scale parameter is determined from the material and the flexure parameter describes the presence of flaws and/or the time to crack initiation. These relations with the physics of materials provide a design basis for calculation of reliability. Author (GRA)

N77-18468# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
THE EFFECTS OF RENEWAL PROCESSES UPON STOCHASTIC RELIABILITY MODELS M.S. Thesis
Louis A. Dugas, Jr. and David H. Hartmann Jun. 1976 279 p refs
(AD-A030297; SLSR-16-76A) Avail: NTIS HC A13/MF A01 CSCL 15/5

Maintenance policies for stochastically failing equipment determine the timing and extent of component replacement. The reliability of the assembly and the demands for assemblies are affected by the replacement of components. Policies may include preventive or opportunistic maintenance. A discrete-event stochastic simulation model is used to determine time related reliability and demand patterns. The model utilizes the Simscript II.5 language. The emphasis of this study is upon the transition period to include the introduction phase of new assemblies until steady state to examine aggregate mean time between failures and demands for assemblies. The assemblies modeled consisted

of components with increasing, decreasing, and constant failure rates. Combinatorial assemblies employing various component failure rates are also modeled to examine the bathtub failure distribution. The data for the combination of five policies and nine type of assemblies are graphically displayed. It was discovered that certain combinations of policies and unit types produced unexpected peaks in aggregated assembly failure rates and demands. Author (GRA)

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N77-18469*# Pennsylvania State Univ., University Park. Dept. of Engineering Science and Mechanics.
DESAP 1: A STRUCTURAL DESIGN PROGRAM WITH STRESS AND DISPLACEMENT CONSTRAINTS. VOLUME 1: THEORETICAL AND USER'S MANUAL
J. Kiusalaas and G. B. Reddy Washington NASA Feb. 1977 122 p refs
(Contract NCA-8-71/72)
(NASA-CR-2794; M-202) Avail: NTIS HC A06/MF A01 CSCL 13M

A finite element program is presented for computer-automated, minimum weight design of elastic structures with constraints on stresses (including local instability criteria) and displacements. Volume 1 of the report contains the theoretical and user's manual of the program. Sample problems and the listing of the program are included in Volumes 2 and 3. The element subroutines are organized so as to facilitate additions and changes by the user. As a result, a relatively minor programming effort would be required to make DESAP 1 into a special purpose program to handle the user's specific design requirements and failure criteria. Author

N77-18470*# Pennsylvania State Univ., University Park. Dept. of Engineering and Science Mechanics.
DESAP 1: A STRUCTURAL DESIGN PROGRAM WITH STRESS AND DISPLACEMENT CONSTRAINTS. VOLUME 2: SAMPLE PROBLEMS
J. Kiusalaas and G. B. Reddy Washington NASA Feb. 1977 102 p refs
(Contract NCA-8-71/72)
(NASA-CR-2795; M-203) Avail: NTIS HC A06/MF A01 CSCL 13M

For abstract, see N77-18469.

N77-18471*# Pennsylvania State Univ., University Park. Dept. of Engineering Science and Mechanics.
DESAP 1: A STRUCTURAL DESIGN PROGRAM WITH STRESS AND DISPLACEMENT CONSTRAINTS. VOLUME 3: PROGRAM LISTING Final Report
J. Kiusalaas and G. B. Reddy Washington NASA Feb. 1977 98 p refs 3 Vol.
(Contract NCA-8-71/72)
(NASA-CR-2796; M-204) Avail: NTIS HC A05/MF A01 CSCL 13M

For abstract, see N77-18469.

N77-18472*# Pennsylvania State Univ., University Park. Dept. of Engineering Science and Mechanics.
DESAP 2: A STRUCTURAL DESIGN PROGRAM WITH STRESS AND BUCKLING CONSTRAINTS. VOLUME 1: THEORETICAL AND USER'S MANUAL Final Report
J. Kiusalaas and G. B. Reddy Washington NASA Mar. 1977 135 p refs 3 Vol.
(Contract NCA-8-71/72)
(NASA-CR-2797; M-205) Avail: NTIS HC A07/MF A01 CSCL 13M

DESAP 2 is described as a finite element program for computer-automated, minimum weight design of elastic structures with constraints on stresses (including local instability criteria) and buckling loads. No limits are placed on the number of load conditions for stress-constrained design, but only one of these load conditions can be chosen as the potential buckling load. A substantial portion of DESAP 2, particularly the analysis of the prebuckling state, is derived from the SOLID SAP finite element program. The stress-constrained design is based on the classical stress ratio method, which drives the design towards a fully stressed state. The constraints on the buckling load are handled by solving the appropriate optimality criterion by successive iterations. During each iteration, the element sizes determined by the stress ratio method are used as the minimum size constraints. The element subroutines are organized in a manner that permits the user to make additions and changes with a minimal programming effort. Consequently, DESAP 2 can readily be changed into a special-purpose program to handle the user's specific design requirements and failure criteria.
Author

N77-18473*# Pennsylvania State Univ., University Park. Dept. of Engineering Science and Mechanics.
DESAP 2: A STRUCTURAL DESIGN PROGRAM WITH STRESS AND BUCKLING CONSTRAINTS. VOLUME 2: SAMPLE PROBLEMS Final Report
J. Kiusalaas and G. B. Reddy Washington NASA Mar. 1977 104 p refs 3 Vol.
(Contract NCA-8-71/72)
(NASA-CR-2798; M-206) Avail: NTIS HC A06/MF A01 CSCL 13M

For abstract, see N77-18472.

N77-18474*# Pennsylvania State Univ., University Park. Dept. of Engineering Science and Mechanics.
DESAP 2: A STRUCTURAL DESIGN PROGRAM WITH STRESS AND BUCKLING CONSTRAINTS. VOLUME 3: PROGRAM LISTING Final Report
J. Kiusalaas and G. B. Reddy Washington NASA Mar. 1977 114 p 3 Vol.
(Contract NCA-8-71/72)
(NASA-CR-2799; M-207) Avail: NTIS HC A06/MF A01 CSCL 13M

For abstract, see N77-18472.

N77-18475*# Old Dominion Univ. Research Foundation, Norfolk, Va. School of Engineering.
ADDITION OF HIGHER ORDER PLATE AND SHELL ELEMENTS INTO NASTRAN COMPUTER PROGRAM Final Report
R. Narayanaswami and G. L. Goglia Dec. 1976 204 p refs (Grant NsG-1117)
(NASA-CR-149761; TR-76-T19) Avail: NTIS HC A10/MF A01 CSCL 13M

Two higher order plate elements, the linear strain triangular membrane element and the quintic bending element, along with a shallow shell element, suitable for inclusion into the NASTRAN (NASA Structural Analysis) program are described. Additions to the NASTRAN Theoretical Manual, Users' Manual, Programmers' Manual and the NASTRAN Demonstration Problem Manual, for inclusion of these elements into the NASTRAN program are also presented. Author

N77-18476*# Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics.
INFLUENCE OF TRANSVERSE SHEAR ON AN AXIAL CRACK IN A CYLINDRICAL SHELL
Steen Krenk (Res. Estab. Risoe, Roskilde, Denmark) Jan. 1977 46 p refs
(Grants NGR-39-007-011; NSF ENG-73-045053-A01)
(NASA-CR-145155) Avail: NTIS HC A03/MF A01 CSCL 13M

An axial crack in a cylindrical shell is investigated by use of a 10th order shell theory, which accounts for transverse shear deformations as well as a special kind of orthotropy. The symmetric problem is formulated in terms of two coupled singular integral equations, which are solved numerically. The asymptotic membrane and bending stress fields ahead of the crack are found to be self similar. Stress intensity factors are given as a function of the shell parameter for various values of the ratio crack length to shell thickness. Considerable differences from

8th order shell theory results are found for the bending stresses, while the membrane stresses of the 8th order theory seems to be a lower limit reached for very thin shells. Author

N77-18477*# Lehigh Univ., Bethlehem, Pa.
A NOTE ON THE BENDING OF A CRACKED STRIP
R. Erdol and F. Erdogan Jan. 1977 14 p refs
(Grants NGR-39-007-011; NSF ENG-73-045053-A01)
(NASA-CR-145156) Avail: NTIS HC A02/MF A01 CSCL 13M

A technique is described for calculating the stress intensity factors in a strip under bending by treating the strip as a two-dimensional continuum rather than a simple beam in evaluating the crack surface tractions used for the solution of the perturbation problem. Author

N77-18478*# Lehigh Univ., Bethlehem, Pa.
THE PROBLEM OF INTERNAL AND EDGE CRACKS IN AN ORTHOTROPIC STRIP
F. Delale and F. Erdogan Jan. 1977 25 p refs
(Grants NGR-39-007-011; NSF ENG-73-045053-A01)
(NASA-CR-145157) Avail: NTIS HC A02/MF A01 CSCL 13M

The plane elastostatic problem of internal and edge cracks in an infinite orthotropic strip is considered. The problems for the material types I and II are formulated in terms of singular integral equations. For the symmetric case the stress intensity factors are calculated and are compared with the isotropic results. The results show that because of the dependence of the Fredholm kernels on the elastic constants, unlike the crack problem for an infinite plane, in the strip the stress intensity factors are dependent on the elastic constants and are generally different from the corresponding isotropic results. Author

N77-18479# California Univ., Livermore. Lawrence Livermore Lab.
DYNAMIC FRACTURE ANALYSIS WITH A LAGRANGIAN FINITE DIFFERENCE METHOD
Y. M. Chen and Mark L. Wilkins 20 Feb. 1976 13 p refs Presented at Conf. on Dyn. Fracture Toughness, London, 5-7 Jul. 1976
(Contract W-7405-eng-48)
(UCRL-77257; Conf-760705-1) Avail: NTIS HC A02/MF A01

Two- and three-dimensional time dependent explicit finite difference methods are used to analyze the stress field around cracks subjected to dynamic tensile loads. Several different notch radii of a notched central crack in a rectangular bar are studied. Both plane strain and plane stress loadings are included. The stress field around a through-the-thickness crack in a section of a cylindrical pipe loaded by a sudden application of pressure is calculated. The plastic strain field around an edge crack in a bar is calculated in plane strain and plane stress geometry. It is pointed out that complex models of material behavior can be easily incorporated into the calculation, but it is the simple elastic material with a sharp crack that places the greatest demands on the calculational procedures. Extrapolation methods are used to determine dynamic stress conditions at the tip of sharp cracks in elastic materials. For rounded cracks, or a crack blunted by plastic flow, the dynamic stress state at a crack tip can be calculated directly. ERA

N77-18480# Ames Lab., Iowa.
STRAIN DISTRIBUTION ANALYSIS IN RING UPSET FORGING AND HOT-ROLLING BY PHOTOPLASTICITY Ph.D. Thesis
Adeyinka Kofoworola Oyilola Jun. 1976 95 p refs
(Contract W-7405-eng-82)
(IS-T-723) Avail: NTIS HC A05/MF A01

A 70 percent rigid Laminac mixed with 30 percent flexible Laminac polyester resin which simulates aluminum deformed at 425 C was used in the strain analysis. A good correlation was found between the neutral radius determined graphically from the three-dimensional strain distribution along the mid-section of the ring plotted against the relative distance, and the neutral radius determined using Avitzur's mathematical solutions for compressed rings. ERA

N77-18481# Brookhaven National Lab., Upton, N.Y. Applied Mathematics Dept.
SURVEY OF DISPLACEMENT METHODS FOR THE PLATE BENDING PROBLEM
L. Ridgway Scott Jun. 1976 25 p refs Presented at US-Germany Symp. on Formulations and Computational Algorithms in Finite Elem. Analysis, Cambridge, Mass., 9-13 Aug. 1976
(Contract E(30-1)-16)
(BNL-21590; Conf-760812-3) Avail: NTIS HC A02/MF A01

The emphasis is on the complications unique to 4th order problems, such as the plate bending problem, that make finite element approximation more difficult than 2nd order problems such as plane stress. The most striking of these is that the polygonal approximation, in the case of a simply supported boundary condition, converges to the wrong answer. The two basic approaches to remedy this in the context of displacement methods are reviewed: alteration of the energy form and modification of the boundary conditions. The ideas presented here are also applicable to the bending portion of some methods for shell analysis. ERA

N77-18482# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
ON THE EFFECT OF THE LOADING RATE ON THE RESIDUAL STRENGTH OF A CRACKED PLATE WITH A HOLE
L. Schra and H. P. VanLeeuwen 9 Dec. 1975 33 p refs Sponsored by Neth. Civil Aviation Board, RLD
(NLR-TR-74172-U) Avail: NTIS HC A03/MF A01

Data presented by Branger, indicating an effect of loading rate on residual strength of aluminum alloys and steels, were analyzed using fracture mechanics. It was found that the apparent effect is largely or wholly due to the combination of two causes: the static data pertain to systematically shorter crack lengths than do the dynamic data; net section failure stresses rather than stress intensities have been presented. The possibility that loading rate effects may occur with other materials and/or under different conditions is not ruled out however. Author (ESA)

N77-18483# Shock and Vibration Information Center (Defense), Washington, D.C.
THE SHOCK AND VIBRATION BULLETIN. PART 2: OPENING SESSION, PANEL SESSION, SHOCK TESTING AND ANALYSIS, FLUID-STRUCTURE TOPICS
Aug. 1976 299 p refs Presented at the 46th Symp. on Shock and Vibration, San Diego, Calif., 20-23 Oct. 1975
(AD-A033420; Bull-46-Pt-2) Avail: NTIS HC A13/MF A01 CSCL 20/11

Partial Contents: Review of Nuclear Blast and Shock Environment Simulation; Vibration Requirements for Reliability Demonstration Tests; Earthquake Test Environment-Simulation and procedure for communications equipment; Alternate Approach to Modal Damping as Applied to Seismic-sensitive Equipment; Actuator Development for System-level Shock Testing; Bounded Impact -- A Repeatable Method for pyrotechnic shock simulation; Dynamic Response of Electrical Cables to Shock Motion; Automated Wheel-on-the-ground Detection by Derailment Impact Sensing Analysis; Development of a Generalized Impact Response Model for a Bulk Cushioning Material; Barrel-tamped, Explosively Propelled Plates for Oblique Impact Experiments; Estimation of Ship Shock Parameters for Consistent Design and Test Specification; Plane Harmonic Waves in Liquid Overlying a Monoclinic, Crystalline Layer; Effect of Phase Shift on Shock Response; Determination of Dynamic Loads from Missile Model Wind Tunnel Data; Feasibility Study of an Acoustic Enclosure for Shuttle Payloads; Experimental Determination of Rocket Motor Structural Response to Internal Acoustic Excitation; and Viscoelastic Damping System as a Remedy for Pogo Effect on the Diamant Satellite Launch Vehicle. GRA

N77-18484# Shock and Vibration Information Center (Defense), Washington, D.C.
THE SHOCK AND VIBRATION BULLETIN. PART 3: ACOUSTIC AND VIBRATION TESTING, IMPACT AND BLAST
Aug. 1976 294 p refs Presented at the 46th Symp. on Shock and Vibration, San Diego, Calif., 20-23 Oct. 1975
(AD-A033421; Bull-46-Pt-3) Avail: NTIS HC A13/MF A01 CSCL 20/11

Partial contents: Simulating Tactical Missile Flight Vibration With Pneumatic Vibrators; Three Directional Vibration System; Dual Shaker Vibration Facility; Analysis of Fatigue under Random Vibration; Random Vibration Fatigue Tests of Weldbonded and Bonded Joints; Fatigue Prediction for Structures Subjected to Random Vibration; Mean Life Evaluation for a Stochastic Loading Programme with a Finite Number of Strain Levels Using Miner's Rule; Thermo-acoustic Simulation of Captive Flight Environment; Effect of Signal Clipping in Random Vibration Testing; Prediction of Standoff Distances to Prevent Hearing loss from Muzzle Blast; Space Shuttle Solid Rocket Booster Nozzle Water Impact Recovery Loads; Axial Forces Generated by Oblique Water Entry of Cones; Delamination of Impacted Composite Plates; Simulation of X-ray Blowoff Impulse Loading on a Reentry Vehicle AFT End Using Light-initiated High Explosive; Blast Pressures inside and outside Suppressive Structures; Development of Structures for Intense Ground Motion Environments; Design of an Experimental Blast Chamber; and Fragment Velocities from Bursting Cylindrical and Spherical Pressure Vessels. GRA

N77-18485# Shock and Vibration Information Center (Defense), Washington, D.C.

THE SHOCK AND VIBRATION BULLETIN. PART 4: MEASUREMENTS AND CRITERIA DEVELOPMENT, ISOLATION AND DAMPING

Aug. 1976 285 p refs Presented at the 46th Symp. on Shock and Vibration, San Diego, Calif., 20-23 Oct. 1975
(AD-A033422; Bull-46-Pt-4) Avail: NTIS HC A13/MF A01 CSCL 20/11

Partial Contents: Boundary Layer Fluctuating Pressure Data Obtained in a High Background Noise Environment; Dynamic Measurement of Low-frequency Components of Track-induced Railcar Wheel Accelerations; Development and Application of a Miniature Recorder/Analyzer for Measurement of the Transportation Environment; Shipping Damage Prevention; Coherence Methods Used to Define Transmission Paths in Airborne Antenna Vibration; Component Random Vibration Requirements and Response Spectra; Statistical Determination of Random Vibration Requirements for Subassembly Tests; Ship Shock Loads Test for Harpoon Missile; Harpoon Missile-Aircraft Launch Ejection Shock Environment; Measurement of Damping and the Detection of Damages in Structures by Random Decrement Technique; Response Analysis of a System with Discrete Dampers; Application of Elastomeric Lead-Lag Dampers to Helicopter Rotors; Evaluation of Isolation Mounts in Reducing Structureborne Noise; Polyurethane Foam Isolators for Shock Isolated Equipment Floors; and Component Testing of Liquid Shock Isolator and Elastomers in Support of Recent Shock Isolation System Designs. GRA

N77-18486# Shock and Vibration Information Center (Defense), Washington, D.C.

THE SHOCK AND VIBRATION BULLETIN. PART 5: DYNAMIC ANALYSIS, MODAL TEST AND ANALYSIS

Aug. 1976 254 p refs Presented at the 46th Symp. on Shock and Vibration, San Diego, Calif., 20-23 Oct. 1975
(AD-A033423; Bull-46-Pt-5) Avail: NTIS HC A12/MF A01 CSCL 20/11

Partial contents: Dynamic Earthquake Analysis of a Bottom Supported Industrial Boiler; Dynamic Response of Laminated Composite Shells; Spectrum and RMS Levels for Stresses in Closely Spaced Stiffened Cylindrical Shells, Subjected to Acoustic Excitation; Analysis of Space Frameworks Containing Curved Beams; Vibrations in Construction Equipment; Model of Soil-Vibrating Machine; General Purpose Computer Graphics Display System for Finite Element Modes; Vibration Characteristics of 1/8-Scale Dynamic Models of Space Shuttle Solid Rocket Boosters; Longitudinal Vibration Characteristics of the Space Shuttle Solid Rocket Booster Test Segment; Mechanical Impedance Techniques in Small Boat Design; Frequencies and Mode Shapes of Geometrically Axisymmetric Structures--Application to a Jet Engine; Eigensolution Sensitivity to Parametric Model Perturbations; Matrix Methods for Analysis of Elastically Supported Isolation Systems; Axisymmetric Structural Loading for a Traveling Overpressure Pulse; Modalab--A new system for structural dynamic testing; Dynamic Behavior of Complex Structures; and Experimental Determination of Vibration Parameters from Time Responses. GRA

N77-18487# Texas Technological Univ., Lubbock. Dept. of Civil Engineering.

THEORETICAL AND EXPERIMENTAL INVESTIGATION OF BURIED CONCRETE STRUCTURES. VOLUME 3: FEASIBILITY STUDY OF TENSILE STRAIN-RATE SENSITIVITY OF CONCRETE Final Report, 1 Apr. 1974 - 31 Aug. 1975

J. H. Smith and K. H. Hoitsma Dec. 1975 26 p refs
(Grant AF-AFOSR-2720-74; AF Proj. 9782)
(AD-A029643; AFOSR-76-1072TR-Vol-3;
AFATL-TR-76-55-Vol-3) Avail: NTIS HC A03/MF A01 CSCL 13/13

For previous research conducted by the project team on the subject of dynamics of buried structures, it was determined that internal blasts excite an arch predominately in a breathing or tensile mode. The critical stresses and strains resulting from such loadings occur in the first few milliseconds after detonation. These critical values, and their relationship to the failure mechanism of plain concrete was the purpose of this research effort. Since a thorough investigation in this area is expensive and time consuming, a short feasibility study was undertaken and a number of reasonably uncomplicated experiments were conducted as a pilot study. Static and dynamic tensile splitting strength tests were performed with varying stress rates. Two loading techniques, an electro-servo-controlled hydraulic and a drop hammer, were tried. While the shape of the loading function was more easily controlled with the hydraulic system, only the drop hammer method was capable of producing the fast (1 to 40 ms.) rise time to failure that was desired. Conclusions were reached that the tensile failure strength of plain concrete can be accurately determined using a drop hammer equipped with a large capacity dynamic load cell (200,000 pound capacity) for rise times in the above mentioned range. Author (GRA)

N77-18488# Texas Technological Univ., Lubbock. Dept. of Civil Engineering.

THEORETICAL AND EXPERIMENTAL INVESTIGATION OF BURIED CONCRETE STRUCTURES. VOLUME 2: USER'S GUIDE TO COMPUTER CODE VANISH Final Report, 1 Apr. 1974 - 31 Aug. 1975

W. P. Vann and J. H. Smith Dec. 1975 67 p
(Grant AF-AFOSR-2720-74; AF Proj. 9782)
(AD-A029539; AFOSR-76-1071TR-Vol-2;
AFATL-TR-76-55-Vol-2) Avail: NTIS HC A04/MF A01 CSCL 13/13

This volume provides details concerning the digital computer code, VANISH, which was developed for analyzing the Static And Dynamic behavior of Nonlinear Interacting Soil Structures and the volume is intended to serve as a user's guide to VANISH. In particular, the code has been designed to be efficient and reliable in determining the response of a soil-covered circular arch used as an aircraft shelter. However, it should also be useful in analyzing a variety of other planar structures. Volume 1 of this report, entitled Summary of Analysis and Experiment gives the fundamental concepts underlying the VANISH code. Nevertheless, most of the knowledge needed merely to use the VANISH code is available from the present volume, and requires only a general understanding of how the code actually solves a given problem. Author (GRA)

N77-18489# Massachusetts Univ., Amherst. Dept. of Civil Engineering.

FINITE ELEMENT ANALYSIS OF A SEISMICALLY EXCITED CYLINDRICAL STORAGE TANK, GROUND SUPPORTED, AND PARTIALLY FILLED WITH LIQUID

Samia Hafiz Shaaban and William A. Nash Jul. 1976 116 p refs
(Grant NSF GI-39644)
(PB-258506/5; NSF/RA-760261) Avail: NTIS HC A06/MF A01 CSCL 13D

The structure under consideration is an elastic cylindrical liquid storage tank attached to a rigid base slab. The tank is filled to an arbitrary depth with an inviscid, incompressible liquid. A finite element analysis is presented for the free vibrations of the coupled system, permitting determination of natural frequencies and associated mode shapes. The response of the partially

filled tank to artificial earthquake excitation is also determined through use of finite elements. Examples, together with program listing, are offered. GRA

N77-18490# Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
EVALUATION OF SEISMIC SAFETY OF BUILDINGS. REPORT NO. 8: INELASTIC RESPONSE SPECTRUM DESIGN PROCEDURES FOR STEEL FRAMES Research Report, Sep. 1975 - Sep. 1976
Richard W. Haviland, John Biggs, and Stavros A. Anagnostopoulos Sep. 1976 146 p refs
(Grant NSF ATA-74-06935)
(PB-258559/4; R76-40) Avail: NTIS HC A07/MF A01 CSCL 13M

Reported is an evaluation of aseismic design procedures based upon inelastic response spectra. Steel frames of different heights are designed for a desired level of yielding using elastic modal analysis. Responses in terms of maximum ductility ratios are computed for simulated ground motions derived from the design spectrum. Both shear beam models and point hinge models are utilized and compared. Results are given in terms of maximum local and story ductility ratios as compared with the design values. The effect of gravity loads on the computed response and the effect of including such loads in the design procedure are investigated. GRA

N77-18491# Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
RANDOM VIBRATION ANALYSIS OF INELASTIC MULTI-DEGREE-OF-FREEDOM SYSTEMS SUBJECTED TO EARTHQUAKE GROUND MOTIONS Ph.D. Thesis
George Gazetas Aug. 1976 322 p refs
(Grant NsF ATA-74-06935)
(PB-258311/0; R76-39; RR-7) Avail: NTIS HC A14/MF A01 CSCL 13M

Extensive simulation studies are used as a guide for the development of the theory, as they yield a better understanding of the elastoplastic dynamic behavior of multistory systems. The theory is evaluated by comparing its response predictions with statistics from multiple time-integration analyses. Various two- and four-degree-of-freedom structures and motions with different frequency content and motion duration are used for this evaluation. GRA

N77-18492# California Univ., Berkeley. Earthquake Engineering Research Center.
STRENGTH AND DUCTILITY EVALUATION OF EXISTING LOW-RISE REINFORCED CONCRETE BUILDINGS - SCREENING METHOD
Tsuneo Okada and Boris Bresler Feb. 1976 234 p refs
(Grant NSF GI-38463)
(PB-257906/8; EERC-76-1) Avail: NTIS HC A11/MF A01 CSCL 13M

A methodology for evaluating the seismic safety of low-rise reinforced concrete buildings and its application to existing school buildings are described. The method classifies buildings according to three types of failure mechanism. In the criteria for evaluating buildings, nonlinear response to two levels of earthquake ground motion is considered. The overall method consists of a sequence of procedures which are repeated in successive cycles, using more refined idealizations of behavior in each cycle. The first cycle of this procedure is called the first screening and is the cycle described in this report. GRA

N77-18493# California Univ., Berkeley. Earthquake Engineering Research Center.
COUPLED LATERAL TORSIONAL RESPONSE OF BUILDINGS TO GROUND SHAKING
Christopher L. Kan and Anil K. Chopra May 1976 179 p refs
(Grants NSF GI-36387; NSF AEN-73-07732-A02)
(PB-257907/6; EERC-76-13) Avail: NTIS HC A09/MF A01 CSCL 13M

The earthquake response of buildings for which the lateral motions are coupled with the torsional motion is presented: (1) The elastic response of torsionally coupled one-story buildings to earthquake ground motion, characterized by idealized shapes for the response spectrum, is studied. (2) A simple procedure is developed for the analysis of the elastic response of a particular class of torsionally coupled multistory buildings to earthquake ground motion, characterized by smooth response spectra. (3) With the aid of perturbation analysis of vibration frequencies and mode shapes it is shown that any lower vibration mode of a torsionally coupled building may be approximated as a linear combination of three vibration modes of the corresponding torsionally uncoupled system. GRA

N77-18494# California Univ., Berkeley. Earthquake Engineering Research Center.
STUDY OF A METHOD OF FEASIBLE DIRECTIONS FOR OPTIMAL ELASTIC DESIGN OF FRAMED STRUCTURES SUBJECTED TO EARTHQUAKE LOADING
N. D. Walker and K. S. Pister Dec. 1975 103 p refs
(Grant NSF AEN-73-07732-A02)
(PB-257781/5; EERC-75-39) Avail: NTIS HC A06/MF A01 CSCL 13M

Optimum design of elastic single bay multistory rigid frames subjected to dead loads and earthquake-generated horizontal ground motion was studied. The basic design problem is cast in the format of mathematical programming. Expressions necessary to solve the problem via the nonlinear programming technique of a method of feasible directions are obtained. For a particular choice of design objective and constraint functions, along with a typical pseudo-velocity response spectrum characterizing the ground motion, examples of the design of one-, two- and eight-story frames are provided. These examples serve to develop insight into the nature of the structural optimization problem under study as well as the operating characteristics of the feasible directions algorithm. GRA

N77-18495# California Univ., Los Angeles. School of Engineering and Applied Science.
APPLICATION OF GLOBAL-LOCAL FINITE ELEMENT METHOD TO FRACTURE MECHANICS
L. G. Bradford, S. B. Dong, D. A. C. Nicol, and R. A. Westmann Sep. 1976 224 p refs
(EPRI Proj. 299-1)
(PB-257753/4; EPRI-NP-239; TR-1) Avail: NTIS HC A10/MF A01 CSCL 20L

The basic theory of the global-local finite element method is summarized. Global elements appropriate for elastic fracture mechanics are developed and presented. Particular global elements developed are for crack types and central cracks in mixed mode loading. A computer program - GLASS 1 - has been developed and is described. Example problems in fracture mechanics have been solved and compared with established results. In all cases extremely accurate results are obtained at a surprisingly low cost. Appendices contain a listing of GLASS 1 and description of the input and output for an example program. A user's manual is included as well. Readers should be alerted to the fact that GLASS 1 has already been modified and improved. The new version-GLASS 2 offers several advantages over GLASS 1. GRA

N77-18496# Georgia Dept. of Transportation, Forest Park. Office of Materials Research.
SURFACE TREATMENT STUDY Interim Report, May 1974 - Jun. 1976
William H. Mills Mar. 1976 223 p refs Sponsored by Federal Highway Admin.
(PB-257271/7; FHWA/RD/M-0316) Avail: NTIS HC A10/MF A01 CSCL 13C

Highway surface treatment in Georgia, recommended revision to specifications, current construction methods and recommendations to improve construction are described. The appendix includes a Surface Treatment Construction Manual and Training Program Outline. The major problems are identified as streaking and bleeding and an investigation into the causes of these problems was made. Three types of bituminous materials were used on surface treatment projects in an attempt to evaluate asphalt pavement types. A test method for uniformity of asphalt application is proposed and preliminary results are presented. GRA

N77-18497# California Univ., Los Angeles. Dept. of Materials.
ACOUSTIC EMISSION DURING FRACTURE-TOUGHNESS

TESTS OF A NUCLEAR PRESSURE VESSEL STEEL AND ITS WELDMENT

Hajime Hatano and Kanji Ono Aug. 1976 19 p refs Presented at 3d Acoustic Emission Symp., Tokyo, 16-18 Sep. 1976 Sponsored in part by Elec. Power Res. Inst.

(Contract N00014-75-C-0419)

(AD-A030188) Avail: NTIS HC A02/MF A01 CSCL 11/6

This paper describes acoustic emission behavior of SA533B steels during fracture toughness tests at 23, -15 and -35 C. Results on AE measurements are summarized and discussed in reference to fractographic observations. Two distinct types of AE signals were recognized by means of waveform, rms voltage changes and amplitude distribution analysis. One type of burst emissions was associated with the formation of equiaxed dimples, while the other type appears to arise from microcracking, tearing, and possibly fracture of inclusions. Author (GRA)

N77-18498# Army Engineer Waterways Experiment Station, Vicksburg, Miss.

USE OF RECYCLED MATERIALS IN AIRFIELD PAVEMENTS. FEASIBILITY STUDY Final Report, Oct. 1974 - Aug. 1975

Raymond J. Lawing Feb. 1976 73 p refs

(AD-A029528; AFCEC-TR-76-7) Avail: NTIS HC A04/MF A01 CSCL 13/2

This report describes an investigation of the economic and technical feasibility of recycling old pavements and used paving materials into new pavement construction and maintenance. It is in effect a state-of-the-art study based on literature reviews and job site visits. Four major procedures were indentified as being used to recycle or reclaim pavements and paving materials. These are: (1) removed and crushed materials, (2) removed and reprocessed materials, (3) pulverized in-place, and (4) heater-planer scarfier or remix methods. GRA

N77-18499# National Bureau of Standards, Washington, D.C. Mechanics Div.

COMPONENT PARTS ASSEMBLY WITH JOINTS, ADHESIVE-MECHANICAL. PART 4: ANALYSIS AND TEST OF BONDED AND WELDBONDED LAP JOINTS Final Report

Richard A. Mitchell, Ruth M. Wooley, and Saul M. Baker Mar. 1976 75 p refs

(AD-A029426; NBSIR-76-1053; PTA-TR-4965) Avail: NTIS HC A04/MF A01 CSCL 13/5

Finite element computer techniques were used to study the linear and nonlinear structural response of bonded and weldbonded lap joints. Although the techniques used are applicable to either single-lap or double-lap joints, the emphasis was on the single-lap joint problem with the attendant complication of joint bending. Nonlinear algorithms were developed to account for nonlinear stress-strain characteristics of the adhesive, and the joined metal sheet, weld-heat softening of the metal sheet, progressive debonding of the adhesive, and nonlinear cyclic loading. The nonlinear modes of response were simulated by sequences of linear solutions. Eight different single-lap joint configurations, designed so as to constitute an experimental parameter study, were studied in a laboratory testing program. Representative specimens were subjected to quasi-static tensile strength and cyclic-load tests and to tensile fatigue tests. The quasi-static and fatigue data generally plot into clear S-N patterns that are in a reasonable relationship to the lap joint design parameters. For the most part, strains measured on the surfaces of the test specimens were in reasonably good agreement with those computed by finite element analysis, provided out-of-plane bending effects were accounted for. The dominant failure modes were consistent with the computer analyses.

Author (GRA)

N77-18500# California Univ., Berkeley. Earthquake Engineering Research Center.

THE SEISMIC BEHAVIOR OF CRITICAL REGIONS OF REINFORCED CONCRETE COMPONENTS AS INFLUENCED BY MOMENT, SHEAR AND AXIAL FORCE

Mehmet Bilgin Atalay and Joseph Penzien Dec. 1975 250 p refs

(Grant NSF AEN-73-07732-A02)

(PB-258842/4) Avail: NTIS HC A11/MF A01 CSCL 13M

A series of twelve members simulating a column between inflection points above and below a floor level were designed and tested dynamically, to determine the characteristics and modes of failure of columns under excitations causing degradation in stiffness, strength and energy absorption. The variable parameters introduced were (1) magnitude of applied axial load chosen to represent lower, intermediate, and upper story columns, (2) lateral reinforcement percentage chosen to study the influence of confinement on ductility, and (3) history of controlled lateral displacement chosen to determine the effects of rate and sequence loading. GRA

N77-18501# Northwestern Univ., Evanston, Ill. Structural Mechanics Lab.

ELASTODYNAMIC EFFECTS ON CRACK ARREST Interim Report

J. D. Achenbach and P. K. Tolikas Jul. 1976 30 p refs Presented at the Symp. on Fast Fracture and Crack Arrest Ann. Meeting of the ASTM, Jun. 1976

(Contract N00014-76-C-0063; NR Proj. 064-483)

(AD-A029652; NU-SML-TR-76-2) Avail: NTIS HC A03/MF A01 CSCL 20/11

In the first part of the paper, elastodynamic stress intensity factors and their role in the fracture criterion of the balance of rates of energies are discussed. The remainder of the paper deals with the near-tip stress field for a sudden discontinuous change of the speed of a rapidly propagating crack tip, including the case that the crack tip is suddenly arrested. Analytical expressions are derived for the elastodynamic stress intensity factor, for the case that the crack tip speed instantaneously changes from c sub 1 to c sub 2, where c sub 2 - c sub 1. Arrest, or continued propagation of a crack tip at a reduced speed are investigated. GRA

N77-18502# Northwestern Univ., Evanston, Ill. Structural Mechanics Lab.

WAVE PROPAGATION, ELASTODYNAMIC STRESS SINGULARITIES AND FRACTURE Interim Report

J. D. Achenbach May 1976 19 p refs Presented at the Intern. Congr. of Theoret. and Appl. Mech., Evanston, Ill.

(Contract N00014-76-C-0063; Grant NSF ENG-70-01465; NR Proj. 064-483)

(AD-A029665; NU-SML-TR-76-1) Avail: NTIS HC A02/MF A01 CSCL 20/11

The singular part of the elastodynamic field in the vicinity of a crack tip plays an important role in fracture mechanics considerations. In this paper analytical, numerical and experimental methods to determine near-tip elastodynamic fields are reviewed, and the interpretation of stress intensity factors is discussed within the context of the fracture criterion of the balance of rates of energies. Elastodynamic effects generated by rapid propagation of the crack as well as by the diffraction of incident stress waves are considered. Propagation in the plane of the crack, as well as skew crack propagation and crack bifurcation are investigated. Author (GRA)

N77-18503# Columbia Univ., New York. Dept. of Civil Engineering and Engineering Mechanics.

PLASTIC BUCKLING OF PLATES WITH EDGE FRICTIONAL SHEAR EFFECTS

Atle Gjelsvik and Guang-Shi Lin Jul. 1976 39 p refs

(Contract N00014-75-C-0695; NR Proj. 064-428)

(AD-A028769; TR-50) Avail: NTIS HC A03/MF A01 CSCL 20/11

It is a well known paradox in the theory of plastic plate buckling that the discredited deformation theory of plasticity predicts the buckling stress well whereas the generally accepted incremental theory predicts a buckling stress which is too high. The present paper explains the paradox which is traced to the fact that prior analytical approaches neglect the effect of friction acting on the loaded edges during tests. The method of analysis makes use of finite element techniques based on incremental theory. Numerical computations were carried out on a digital computer. The shear stresses introduced by the edge friction have the effect of substantially lowering the buckling stress. The numerical results compare well with the experimental data obtained by Pride and Heimerl. The paper indicates that the inclusion of frictional effects is crucial to obtain realistic results for plate buckling in the plastic range. Author (GRA)

N77-18504# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
THE FINITE ANTI-PLANE SHEAR FIELD NEAR THE TIP OF A CRACK FOR A CLASS OF INCOMPRESSIBLE ELASTIC SOLIDS
James K. Knowles Jul. 1976 63 p refs
(Contract N00014-75-C-0196)
(AD-A028247; TR-35) Avail: NTIS HC A04/MF A01 CSCL 20/11

The present paper is concerned with an infinite slab containing a crack and deformed at infinity to a state of finite simple shear. The material of the slab is taken to be homogeneous, isotropic, elastic, and incompressible, and is further assumed to belong to a class of materials which admit nontrivial states of anti-plane shear. The analysis is carried out for the fully nonlinear equilibrium theory of finite elasticity. The stress field near the crack-tips is studied in detail; one of the special materials considered is such that the shear stresses near a crack tip remain bounded, despite the presence of unbounded displacement gradients. An analogy between the crack problem in finite anti-plane shear and the problem of transonic flow of a gas past a flat plate is pointed out and discussed. Author (GRA)

N77-18505# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
FIDAG, A PROGRAM FOR FINITE DIFFERENCE INTERPOLATION ON AN ARBITRARY GRID Final Report
Paul S. Jensen 9 Apr. 1976 73 p refs
(Contract F44620-71-C-0109; AF Proj. 9749)
(AD-A027773; LMSC-D502136; AFOSR-76-0863TR) Avail: NTIS HC A04/MF A01 CSCL 20/11

This report documents the computer program FIDAG for performing finite difference analysis on arbitrary two-dimensional grids. Besides the detailed descriptions of the mathematical, numerical and implementation considerations for FIDAG, practical considerations for its utilization are discussed. Specific applications for the solution of partial differential equations and bivariate interpolation are treated along with sample numerical results. A simple data base system for convenient interface with engineering analysis programs such as STAGS (Structural Analysis of General Shells) is also discussed. These programs have been interfaced and sample results from the STAGS-FIDAG combination are presented. GRA

N77-18506# Lehigh Univ., Bethlehem, Pa. Inst. of Fracture and Solid Mechanics.
STRESS SINGULARITY FOR A CRACK WITH AN ARBITRARILY CURVED FRONT
R. J. Hartranft and G. C. Sih Apr. 1976 51 p refs
(Contract N00014-76-C-0094)
(AD-A030757) Avail: NTIS HC A04/MF A01 CSCL 20/11

To investigate the possibility of a point of a crack front propagating in a direction not in the normal plane of the crack front, the three-dimensional form of the crack front stress field is obtained. To simplify comparisons of the states of stress at various points lying on a spherical surface centered at a point of the crack front, a local spherical coordinate system is used. It is found that the crack propagation will be from each point of the crack front in a direction lying in the normal plane. The results are used in conjunction with the strain energy density fracture criterion for the problem of an elliptical crack. The plane of the flat elliptical crack makes an arbitrary angle with the field of uniform applied tensile stress. Crack growth directions for various positions along the crack front are determined, and loads required for fracture for various angles are obtained. Author (GRA)

N77-18507# Lehigh Univ., Bethlehem, Pa. Inst. of Fracture and Solid Mechanics.
GROWTH CHARACTERISTICS OF A THROUGH CRACK IN A PLATE SPECIMEN
P. D. Hilton, G. C. Sih, and B. V. Kiefer Aug. 1976 69 p refs
(Contract N00014-76-C-0094; NR Proj. 064-562)
(AD-A030758; IFSM-76-76) Avail: NTIS HC A04/MF A01 CSCL 20/11

This report describes the results of a theoretical study of the problem of a through crack in a tensile plate specimen. Experimental observations indicate that the crack front grows stably in the specimen interior forming a 'thumb nail' shape prior to unstable fracture. The amount of interior growth before fracture is found to depend on both geometry (relative specimen thickness), the material properties, and the amount of yielding which tends to delay the onset of rapid fracture. The goal of this work is to study the interaction of material nonlinearity with geometry and their combined effect on the fracture process. To this end, two-dimensional elastic-plastic and three-dimensional elastic calculations have been performed. The finite element method, specialized to crack problems, is the tool used to obtain numerical results. Predictions on the increments of growth along the crack front are made on the basis of the strain energy density theory that assumed crack trajectory to coincide with path of minimum strain energy density function. Related three-dimensional elastic-plastic calculations are currently being developed to complete the modeling of the ductile fracture process in plate specimens. Author (GRA)

N77-18030*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOADS TECHNOLOGY FOR SUPERSONIC CRUISE AIRCRAFT
Robert C. Goetz *In its* Proc. of the SCAR Conf., Pt. 2, 1976 22 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 13M

N77-18854# Northwestern Univ., Evanston, Ill.
GENERALIZED CONTINUUM THEORIES FOR DIRECTIONALLY REINFORCED SOLIDS
J. D. Achenbach *In* Polish Acad. Sci. Arch. Mech. 1976 p 257-278 refs (For primary document see N77-18853 09-70)
(Contract N00014-67-A-0356-0034)
Copyright. Avail: Issuing Activity

N77-18855# Technische Hogeschool, Eindhoven (Netherlands).
A NOTE ON THE PHYSICAL FOUNDATION OF THE THEORY OF MULTIPOLE-STRESSES
J. B. Alblas *In* Polish Acad. Sci. Arch. Mech. 1976 p 279-298 refs (For primary document see N77-18853 09-70)
Copyright. Avail: Issuing Activity

N77-18856# McGill Univ., Montreal (Quebec). Micromechanics of Solids Lab.
MICROMECHANICS OF DISCRETE SYSTEMS
D. R. Axelrad *In* Polish Acad. Sci. Arch. Mech. 1976 p 299-315 refs (For primary document see N77-18853 09-70)
Copyright. Avail: Issuing Activity

N77-18857# Colorado Univ., Boulder. Dept. of Mechanical Engineering.
SCATTERING OF ELASTIC WAVES BY A DISTRIBUTION OF INCLUSIONS
S. K. Datta *In* Polish Acad. Sci. Arch. Mech. 1976 p 317-324 refs (For primary document see N77-18853 09-70)
Copyright. Avail: Issuing Activity

N77-18861# Polish Academy of Sciences, Warsaw. Inst. of Fundamental Technological Research.
PLASTIC STRAINS IN COMPOSITE MEDIA
Cz. Eimer *In its* Arch. Mech. 1976 p 369-384 refs (For primary document see N77-18853 09-70)
Copyright. Avail: Issuing Activity

N77-18864# Stanford Univ., Calif. Div. of Applied Mechanics.
ON CONTINUUM MODELING OF THE DYNAMIC BEHAVIOR OF LAYERED COMPOSITES
G. Herrmann, R. K. Kaul, and T. J. Delph *In* Polish Acad. Sci. Arch. Mech. 1976 p 405-421 refs Sponsored in part by NSF (For primary document see N77-18853 09-70)
(Contract N00014-76-C-0054; Grant AF-AFOSR-2669-74)
Copyright. Avail: Issuing Activity

N77-18866# Heriott-Watt Univ., Edinburgh (Scotland). Dept. of Mathematics.
CONVERGENCE OF SOLUTIONS OF THE EQUATIONS OF DYNAMIC LINEAR DIPOLAR ELASTICITY TO THE SOLUTIONS OF CLASSICAL ELASTODYNAMICS

R. J. Knops and B. Straughan *In* Polish Acad. Sci. Arch. Mech. 1976 p 431-441 refs (For primary document see N77-18853 09-70)
Copyright. Avail: Issuing Activity

N77-18872# Polish Academy of Sciences, Warsaw.
ON THE THEORY OF LINEAR ELASTICITY IN STATISTICALLY HOMOGENEOUS MEDIA
P. Mazilu *In its* Arch. Mech. 1976 p 517-529 refs (For primary document see N77-18853 09-70)
Copyright. Avail: Issuing Activity

42 GEOSCIENCES (GENERAL)

N77-18508# Los Alamos Scientific Lab., N.Mex.
GEOSCIENCES AT LOS ALAMOS SCIENTIFIC LABORATORY (LASL) Progress Report, 1 Jul. - 31 Dec. 1975
John C. Fichelberger, comp. May 1976 65 p refs
(Contract W-7405-eng-36)
(LA-6335-PR) Avail: NTIS HC A04/MF A01

Processes operating in the hot areas of the earth's crust are investigated. The closely related applied problem of using the hot, dry rock of these regions as a source of geothermal energy is explored. Studies include mass and heat transfer in the crust and upper mantle, phases in crust and upper mantle rocks, near surface and surface behavior of magma (including eruption phenomenology), rock-water interaction at magmatic to surface temperatures, seismology, advanced drilling techniques applicable to hot rocks, geology and geophysics of the Fenton Hill geothermal experiment site, and evaluation of future sites.
ERA

N77-18509# National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.
LONG-RANGE FORECASTING OF MAXIMUM ICE EXTENT ON THE GREAT LAKES
Jeffery C. Rogers Jan. 1976 20 p refs
(PB-259694/8; NOAA-TM-ERL-GLERL; GLERL-Contrib-55; NOAA-76082303) Avail: NTIS HC A02/MF A01 CSCL 08L

A technique, based on prewinter thawing and wintertime freezing degree-days, has been developed for making long-range forecasts of the percent maximum ice extent on the Great Lakes. This was accomplished by using an average March 3 accumulated freezing degree-day value from both the large and small ice extent winters between 1962-63 and 1968-69, which alternate in a quasi-biennial cycle. The equations and freezing degree-day prediction method were then used to hindcast maximum ice extent on the Lakes during the winters 1969-70 to 1974-75.
GRA

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N77-18510* Regional Planning Commission for Jefferson, Orleans, St. Bernard, and St. Tammany Parishes, New Orleans, La.
ST. TAMMANY PARISH LAND-USE REPORT Final Report
Mar. 1976 127 p refs Sponsored in part by NASA and DOT
(Contract HUD-CPA-LA-06-48-1060)
(NASA-CR-149675) Avail: Issuing Activity CSCL 05B

This report involves an inventory and maps of existing land use, base mapping, and a series of experimental techniques for land use determination in St. Tammany Parish, Louisiana. Author

N77-18511*# New Mexico State Bureau of Mines and Mineral Resources, Socorro.
ANALYSIS OF LANDSAT B IMAGERY AS A TOOL FOR EVALUATING, DEVELOPING, AND MANAGING THE NATURAL RESOURCES OF NEW MEXICO Final Report, Mar. 1975 - Aug. 1976
David Tabet, Principal Investigator, Michael Inglis (New Mexico Univ., Albuquerque), Stanley Morain (New Mexico Univ., Albuquerque), Linda Love (New Mexico Univ., Albuquerque), Sandra Feldman (New Mexico Univ., Albuquerque), and Thomas Budge (New Mexico Univ., Albuquerque) Aug. 1976 116 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. ERTS
(Contract NAS5-20916)
(E77-10090; NASA-CR-149573) Avail: NTIS HC A06/MF A01 CSCL 08F

The author has identified the following significant results. A statewide land use and vegetation map was prepared by visual interpretation of LANDSAT images; geologic structure and metal deposits of the Datil-Mogollon volcanic area were investigated. Computer enhanced images of the San Juan Basin region were studied for evidence of uranium, oil, and gas deposits. Little success was achieved with the uranium, oil, and gas studies, while roughly half the metal targets picked in the Datil-Mogollon area coincided with known area of mineralization.

N77-18512*# Division of National Mapping, Canberra (Australia).
MAPPING ISLANDS, REEFS AND SHOALS IN THE OCEANS SURROUNDING AUSTRALIA Final Report, 8 Aug. 1975 - 8 Aug. 1976
Leonard G. Turner, Principal Investigator 8 Nov. 1976 14 p ref Sponsored by NASA ERTS
(E77-10091; NASA-CR-149574) Avail: NTIS HC A02/MF A01 CSCL 08B

The author has identified the following significant results. Contours of residual errors were depicted in east and north directions. Contours were constructed from residuals which were determined at 22 ground control points. Residuals at two control points were rejected from contour determination, as their magnitudes were not in keeping with surrounding values. Results obtained so far from depth measurement tests are only tentative. Both sucessful and unsuccessful correlations were depicted between the imagery intensities and bathymetric data. Using the results from nine profile comparisons abstracted from a scene over Torres Strait, where water was generally very clear, an empirical relationship between image intensity (1) and water depth (d) was derived: $1 = 30 - 0.75\ d$.

N77-18513*# Ministry of Natural Resources, Nairobi (Kenya).
NASA-KENYA LANDSAT PROGRAMME Progress Report
J. H. O. Omino, Principal Investigator 27 Jan. 1977 3 p Sponsored by NASA ERTS
(E77-10092; NASA-CR-149575) Avail: NTIS HC A02/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N77-18514*# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).
WATER UTILIZATION, EVAPOTRANSPIRATION AND SOIL MOISTURE MONITORING IN THE SOUTH EAST REGION OF SOUTH AUSTRALIA Quarterly Progress Report
K. R. McCloy, Principal Investigator, K. John Shepherd, and J. C. Killick 2 Sep. 1976 16 p refs Sponsored by NASA ERTS
(E77-10096; NASA-CR-149579; QPR-3) Avail: NTIS HC A02/MF A01 CSCL 08H

There are no author-identified significant results in this report.

N77-18515*# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).
WATER UTILIZATION, EVAPOTRANSPIRATION AND SOIL MOISTURE MONITORING IN THE SOUTH EAST REGION OF SOUTH AUSTRALIA Quarterly Progress Report
K. R. McCloy, Principal Investigator, K. John Shepherd, and J. C. Killick 2 Sep. 1976 5 p Sponsored by NASA ERTS
(E77-10097; NASA-CR-149580; QPR-4) Avail: NTIS HC A02/MF A01 CSCL 08H

There are no author-identified significant results in this report.

N77-18516*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
DETECTION AND MAPPING (DAM) PACKAGE. VOLUME 1: GENERAL PROCEDURE Final Report, Jan. - Jun. 1976
Edward H. Schlosser, Principal Investigator and M. L. Brown Jun. 1976 28 p EREP
(Contract NAS9-12200)
(E77-10100; NASA-CR-147873; LEC-8663-Vol-1; JSC-11376-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 08H

The author has identified the following significant results. The DAM package is an integrated set of manual procedures, computer programs, and graphic devices designed for efficient production of precisely registered and formatted maps from digital LANDSAT multispectral scanner data. The software can be readily implemented on any Univac 1100 series computer with standard peripheral equipment. This version of the software includes predefined spectral limits for use in classifying and mapping surface water.

N77-18517*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
DETECTION AND MAPPING (DAM) PACKAGE. VOLUME 2A: SOFTWARE USER MANUAL (PART 1) Final Report, Jan. - Jun. 1976
Edward H. Schlosser, Principal Investigator and M. L. Brown Jun. 1976 80 p EREP
(Contract NAS9-12200)
(E77-10101; NASA-CR-147874; LEC-8663-Vol-2a; JSC-11377-Vol-2a) Avail: NTIS HC A05/MF A01 CSCL 08H

For abstract, see N77-18516.

N77-18518*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
DETECTION AND MAPPING (DAM) PACKAGE. VOLUME 2B: SOFTWARE USER MANUAL (PART 2) Final Report, Jan. - Jun. 1976
Edward H. Schlosser, Principal Investigator Jun. 1976 144 p EREP
(Contract NAS9-12200)
(E77-10102; NASA-CR-147875; LEC-8663-Vol-2b; JSC-11378-Vol-2b) Avail: NTIS HC A07/MF A01 CSCL 08H

For abstract see, N77-18516.

N77-18519*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
DETECTION AND MAPPING (DAM) PACKAGE. VOLUME 3: CONTROL NETWORK ESTABLISHMENT Final Report, Jan. - Jun. 1976
Edward H. Schlosser, Principal Investigator Jun. 1976 50 p refs EREP
(Contract NAS9-12200)
(E77-10103; NASA-CR-147876; LEC-8663-Vol-3; JSC-11379-Vol-3) Avail: NTIS HC A03/MF A01 CSCL 08H

For abstract see, N77-18516.

N77-18520*# South Dakota State Univ., Brookings. Remote Sensing Inst.
APPLICATION OF REMOTE SENSING TECHNOLOGY TO LAND EVALUATION, PLANNING UTILIZATION OF LAND RESOURCES, AND ASSESSMENT OF WESTLAND HABITAT IN EASTERN SOUTH DAKOTA, PARTS 1 AND 2 Annual Progress Report, 1 Jul. 1975 - 30 Jun. 1976
Victor I. Myers, Principal Investigator, T. L. Cox, and R. G. Best 30 Jun. 1976 83 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Grant NGL-42-003-007)
(E77-10104; NASA-CR-149590; SDSU-RSI-76-07-Pt-1; SDSU-RSI-76-07-Pt-2) Avail: NTIS HC A05/MF A01 CSCL 08F

The author has identified the following significant results. LANDSAT fulfilled the requirements for general soils and land use information. RB-57 imagery was required to provide the information and detail needed for mapping soils for land evaluation. Soils maps for land evaluation were provided on clear mylar at the scale of the county highway map to aid users in locating mapping units. Resulting mapped data were computer processed to provided a series of interpretive maps (land value, limitations to development, etc.) and area summaries for the users.

N77-18521*# Alaska Univ., Fairbanks. Inst. of Arctic Biology.
ON VEGETATION MAPPING IN ALASKA USING LANDSAT IMAGERY WITH PRIMARY CONCERNS FOR METHOD AND PURPOSE IN SATELLITE IMAGE-BASED VEGETATION AND LAND-USE MAPPING AND THE VISUAL INTERPRETATION OF IMAGERY IN PHOTOGRAPHIC FORMAT Final Report, 1 Aug. 1972 - 30 Apr. 1975
J. H. Anderson, Principal Investigator Oct. 1976 195 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21833)
(E77-10105; NASA-CR-149591) Avail: NTIS HC A09/MF A01 CSCL 08F

The author has identified the following significant results. A simulated color infrared LANDSAT image covering the western Seward Peninsula was used for identifying and mapping vegetation by direct visual examination. The 1:1,083,400 scale print used was prepared by a color additive process using positive transparencies from MSS bands 4, 5, and 7. Seven color classes were recognized. A vegetation map of 3200 sq km area just west of Fairbanks, Alaska was made. Five colors were recognized on the image and identified to vegetation types roughly equivalent to formations in the UNESCO classification: orange - broadleaf deciduous forest; gray - needleleaf evergreen forest; light violet - subarctic alpine tundra vegetation; violet - broadleaf deciduous shrub thicket; and dull violet - bog vegetation.

N77-18522*# Mississippi State Univ., Mississippi State.
APPLICATION OF REMOTE SENSING TO STATE AND REGIONAL PROBLEMS Semiannual Progress Report, 1 May - 30 Oct. 1976
W. Frank Miller, Principal Investigator, Jerry C. Harris, Bradley D. Carter, and David E. Pettry 1 Nov. 1976 65 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Grant NGL-25-001-054)
(E77-10107; NASA-CR-149593; SAPR-6) Avail: NTIS HC A04/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N77-18523*# Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.
MULTIPLE RESOURCE EVALUATION OF REGION 2 US FOREST SERVICE LANDS UTILIZING LANDSAT MSS DATA Final Report, 20 Feb. 1975 - 20 Jul. 1976
Paula V. Krebs and Roger M. Hoffer, Principal Investigators (Purdue Univ.) Jul. 1976 342 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-20948)
(E77-10108; NASA-CR-149595) Avail: NTIS HC A15/MF A01 CSCL 02F

The author has identified the following significant results. LANDSAT MSS imagery provided an excellent overview which put a geomorphic study into a regional perspective, using scale 1:250,000 or smaller. It was used for deriving a data base for land use planning for southern San Juan Mountains. Stereo pairing of adjacent images was the best method for all geomorphic mapping. Combining this with snow enhancement, seasonal enhancement, and reversal aided in interpretation of geomorphic features. Drainage patterns were mapped in much greater detail from LANDSAT than from a two deg quadrangle base.

N77-18524*# Pennsylvania State Univ., University Park. Office for Remote Sensing of Earth Resources.
DIAZO PRINTING OF ERTS COLOR COMPOSITES Interim Report
George J. McMurtry, Gary W. Petersen, Principal Investigators, and W. S. Kowalik Jul. 1975 5 p refs ERTS
(Contract NAS5-23133)
(E77-10109; NASA-CR-149596; ORSER-SSEL-TR-11-75) Avail: NTIS HC A02/MF A01 CSCL 14E

The author has identified the following significant results. ERTS-1 color composites were made with the help of a Diazo developer and printer. Five single channel, density standards were established, using typical ERTS images, in order to determine exposure time. These standards were used to develop a graph from which the exposure time for any transparency can be estimated. Exposure times varied from 3 to 30 minutes, and clear colored polyester sheets from two manufactures were used with slightly different, but equally successful, results.

N77-18525*# Pennsylvania State Univ., University Park. Office for Remote Sensing of Earth Resources.
INTERPRETATION OF PENNSYLVANIA AGRICULTURAL LAND USE FROM ERTS-1 DATA Interim Report
George J. McMurtry, Gary W. Petersen, Principal Investigators, and A. D. Wilson Dec. 1974 25 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-23133)
(E77-10111; NASA-CR-149284; ORSER-SSEL-TR-20-74) Avail: NTIS HC A02/MF A01 CSCL 05B

The author has identified the following significant results. To study the complex agricultural patterns in Pennsylvania, a portion of an ERTS scene was selected for detailed analysis. Various photographic products were made and were found to be only of limited value. This necessitated the digital processing of the ERTS data. Using an unsupervised classification procedure, it was possible to delineate the following categories: (1) forest land with a northern aspect, (2) forest land with a southern aspect, (3) valley trees, (4) wheat, (5) corn, (6) alfalfa, grass, pasture, (7) disturbed land, (8) builtup land, (9) strip mines, and (10) water. These land use categories were delineated at a scale of approximately 1:20,000 on the line printer output. Land use delineations were also made using the General Electric IMAGE 100 interactive analysis system.

N77-18526*# Pakistan Water and Power Development Authority, Lahore.
WATER RESOURCES INVESTIGATION IN WEST PAKISTAN WITH THE HELP OF ERTS IMAGERY: SNOW SURVEYS
Ch. Mohammed Umar, Principal Investigator Sep. 1976 43 p Sponsored by NASA ERTS
(E77-10113; NASA-CR-149562) Avail: NTIS HC A03/MF A01 CSCL 08H

There are no author-identified significant results in this report.

N77-18527*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
ANALYTICAL AND EXPERIMENTAL DESIGN AND ANALYSIS OF AN OPTIMAL PROCESSOR FOR IMAGE REGISTRATION
C. D. McGillem, Principal Investigator, Martin Svedlow, and P. E. Anuta 1976 179 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-14016)
(E77-10114; NASA-CR-151100; LARS-IN-090776; T-1314/3) Avail: NTIS HC A09/MF A01 CSCL 14E

The author has identified the following significant results. A quantitative measure of the registration processor accuracy in terms of the variance of the registration error was derived. With the appropriate assumptions, the variance was shown to be inversely proportional to the square of the effective bandwidth times the signal to noise ratio. The final expressions were presented to emphasize both the form and simplicity of their representation. In the situation where relative spatial distortions exist between images to be registered, expressions were derived for estimating the loss in output signal to noise ratio due to these spatial distortions. These results are in terms of a reduction factor.

N77-18528*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
A NEW IMAGE ENHANCEMENT ALGORITHM WITH APPLICATIONS TO FORESTRY STAND MAPPING
Edwin P. F. Kan, Principal Investigator and Jinn-Kai Lo Jun. 1975 48 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-12200)
(E77-10115; NASA-CR-150915; LEC-6178; JSC-09695) Avail: NTIS HC A03/MF A01 CSCL 02F

The author has identified the following significant results. Results show that the new algorithm produced cleaner classification maps in which holes of small predesignated sizes were eliminated and significant boundary information was preserved. These cleaner post-processed maps better resemble true life timber stand maps and are thus more usable products than the pre-post-processing ones: Compared to an accepted neighbor-checking post-processing technique, the new algorithm is more appropriate for timber stand mapping.

N77-18529*# Department of the Environment, Ottawa (Ontario).
RETRANSMISSION OF HYDROMETRIC DATA IN CANADA Quarterly Report, Oct. - Dec. 1976
R. A. Halliday, Principal Investigator, I. A. Reid, and A. C. D. Terroux Dec. 1976 25 p Sponsored by NASA ERTS
(E77-10116; NASA-CR-149651) Avail: NTIS HC A02/MF A01 CSCL 02F

The author has identified the following significant results. The project continues to demonstrate the feasibility of transmitting hydrometric data to polar orbiting spacecraft and using these data operationally. All elements on the system are functioning well.

N77-18530*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
DETERMINING LAND USE PATTERNS THROUGH MAN-MACHINE ANALYSIS OF LANDSAT DATA: A TUTORIAL SIMULATION
Stevan J. Kristof, Principal Investigator, James D. Russell, Tina K. Cary, Bruce M. Lube, and Richard A. Weismiller 1976 56 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contracts NAS9-14016; NAS9-14970)
(E77-10117; NASA-CR-151162; LARS-IN-070676; T-1039/4) Avail: NTIS HC A04/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N77-18531*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
TRI-COUNTY PILOT STUDY
C. A. Reeves, Principal Investigator, T. W. Austin, and A. G. Kerber Jul. 1976 90 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-12200)
(E77-10118; NASA-CR-147887; LEC-8657; JSC-11473) Avail: NTIS HC A05/MF A01 CSCL 08F

The author has identified the following significant results. An area inventory was performed for three southeast Texas counties (Montgomery, Walker, and San Jacinto) totaling 0.65 million hectares. The inventory was performed using a two level hierarchy. Level 1 was divided into forestland, rangeland, and other land. Forestland was separated into Level 2 categories: pine, hardwood, and mixed; rangeland was not separated further. Results consisted of area statistics for each county and for the entire study site for pine, hardwood, mixed, rangeland, and other land. Color coded county classification maps were produced for the May data set, and procedures were developed and tested.

N77-18532*# Michigan State Univ., East Lansing.
USE OF REMOTE SENSING FOR LAND USE POLICY

FORMULATION Semiannual Progress Report, Jun. - Nov. 1976
Myles Boylan 23 Feb. 1977 34 p refs
(Grant NGL-23-004-083)
(NASA-CR-149664) Avail: NTIS HC A03/MF A01 CSCL 08B

The use of remotely sensed data for eliminating abuses and mismanagement of land and water resources in Michigan is discussed. Applications discussed include inventory of mosquito breeding sites; analysis of biomass in old field ecosystems used for wastewater recycling; areas for agricultural use; and preservation of the Grand Mere Dune environment. Services to users are described and contact activities reported. Author

N77-18533*# A & M Associates, Lanham, Md.
ON THE REMOTE MEASUREMENT OF EVAPORATION RATES FROM BARE WET SOIL UNDER VARIABLE CLOUD COVER Final Report, Nov. 1975 - Nov. 1976
Siegfried Auer [Nov. 1976] 41 p refs
(Contract NAS5-22815)
(NASA-CR-152429) Avail: NTIS HC A03/MF A01 CSCL 08M

Evaporation rates from a natural wet soil surface are calculated from an energy balance equation at 0.1-hour intervals. A procedure is developed for calculating the heat flux through the soil surface from a harmonic analysis of the surface temperature curve. The evaporation integrated over an entire 24-hour period is compared with daily evaporation rates obtained from published models. Author

N77-18534*# Bendix Corp., Ann Arbor, Mich. Aerospace systems Div.
SIMULATION OF THEMATIC MAPPER PERFORMANCE AS A FUNCTION OF SENSOR SCANNING PARAMETERS Final Report
Robert H. Johnson, Navinchandra J. Shah, and Norman F. Schmidt 1 Oct. 1975 57 p
(Contract NAS5-20821)
(NASA-CR-152436; BSR-4202) Avail: NTIS HC A04/MF A01 CSCL 08B

The investigation and results of the Thematic Mapper Instrument Performance Study are described. The Thematic Mapper is the advanced multispectral scanner initially planned for the Earth Observation Satellite and now planned for LANDSAT D. The use of existing digital airborne scanner data obtained with the Modular Multispectral Scanner (M2S) at Bendix provided an opportunity to simulate the effects of variation of design parameters of the Thematic Mapper. Analysis and processing of this data on the Bendix Multispectral Data Analysis System were used to empirically determine categorization performance on data generated with variations of the sampling period and scan overlap parameters of the Thematic Mapper. The Bendix M2S data, with a 2.5 milliradian instantaneous field of view and a spatial resolution (pixel size) of 10-m from 13,000 ft altitude, allowed a direct simulation of Thematic Mapper data with a 30-m resolution. The flight data chosen were obtained on 30 June 1973 over agricultural test sites in Indiana. Author

N77-18535*# Clemson Univ., S.C. Dept. of Horticulture.
CROP STATUS EVALUATIONS AND YIELD PREDICTIONS Final Report, 1 Apr. 1974 - 1 Oct. 1976
J. R. Haun 27 Sep. 1976 76 p refs
(Contract NAS9-14006)
(NASA-CR-151180) Avail: NTIS HC A05/MF A01 CSCL 02C

One phase of the large area crop inventory project is presented. Wheat yield models based on the input of environmental variables potentially obtainable through the use of space remote sensing were developed and demonstrated. By the use of a unique method for visually qualifying daily plant development and subsequent multifactor computer analyses, it was possible to develop practical models for predicting crop development and yield. Development of wheat yield prediction models was based on the discovery that morphological changes in plants are detected and quantified on a daily basis, and that this change during a portion of the season was proportional to yield. Author

N77-18536*# Los Alamos Scientific Lab., N.Mex.
CATALOGUE OF SATELLITE PHOTOGRAPHY OF THE ACTIVE VOLCANOES OF THE WORLD
Grant Heiken Mar. 1976 29 p Sponsored by NASA
(Contract W-7405-eng-36)
(NASA-CR-149618; LA-6297-MS) Avail: NTIS HC A03/MF A01 CSCL 08K

A catalogue is presented of active volcanoes as viewed from Earth-orbiting satellites. The listing was prepared of photographs, which have been screened for quality, selected from the earth resources technology satellite (ERTS) and Skylab, Apollo and Gemini spacecraft. There is photography of nearly every active volcano in the world; the photographs are particularly useful for regional studies of volcanic fields. ERA

N77-18537*# Kanner (Leo) Associates, Redwood City, Calif.
PHYSICAL-GEOGRAPHIC AND HYDROLOGIC DESCRIPTION OF THE TEST SITE IN THE USSR (MOUNTAIN REGION OF THE SYRDAR'YA RIVER BASIN IN THE NORTHERN PART OF THE FERGANA DEPRESSION) AND DATA ON GROUND HYDROLOGIC, METEOROLOGIC, AND ACTINOMETRIC MEASUREMENTS
Washington NASA Feb. 1977 48 p refs Transl. into ENGLISH from report from Inst. of Water Problems, USSR Academy of Sciences, (Moscow), 1976 p 1-22
(Contract NASw-2790)
(NASA-TT-F-17523) Avail: NTIS HC A03/MF A01 CSCL 08F

Mountain configuration, elevation distribution, river patterns, soil types, and irrigation systems are described for the test site (mountain region of the Syrdar'ya River basin in the northern part of the Fergana Depression). Mean-diurnal, mean-monthly, and mean-multiannual discharge data are given for the flows of the most important rivers. Springs and streams are described as to their numbers and total yield. Typical vegetation in the various soils is described by region. Author

N77-18538*# Joint Publications Research Service, Arlington, Va.
STUDY OF THE EARTH FROM ORBIT
A. Koval and L. Desinov Washington NASA Mar. 1977 8 p Transl. into ENGLISH from Aviat. Kosmonavt. (USSR), no. 12, 1976 p 36-37
(NASA Order W-13183)
(NASA-TT-F-17519) Avail: NTIS HC A02/MF A01 CSCL 08F

A new step in studying the natural resources of Earth from space is discussed -- multizonal photography -- simultaneous photography of the terrain in different narrow sections of the spectrum of electromagnetic radiation. Author

N77-18539*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
REMOTE SENSING OPERATIONS (MULTISPECTRAL SCANNER AND PHOTOGRAPHIC) IN THE NEW YORK BIGHT, 22 SEPTEMBER 1975
Robert W. Johnson and John B. Hall, Jr. Feb. 1977 14 p ref
(NASA-TM-X-73993) Avail: NTIS HC A02/MF A01 CSCL 14E

Ocean dumping of waste materials is a significant environmental concern in the New York Bight. One of these waste materials, sewage sludge, was monitored in an experiment conducted in the New York Bight on September 22, 1975. Remote sensing over controlled sewage sludge dumping included an 11-band multispectral scanner, fiver multispectral cameras and one mapping camera. Concurrent in situ water samples were taken and acoustical measurements were made of the sewage sludge plumes. Data were obtained for sewage sludge plumes resulting from line (moving barge) and spot (stationary barge) dumps. Multiple aircraft overpasses were made to evaluate temporal effects on the plume signature. Author

N77-18540*# Scientific Translation Service, Santa Barbara, Calif.
RESULTS OF INVESTIGATIONS OF THE MOISTURE OF SOILS BY THE SUPERHIGH FREQUENCY RADIOMETRIC METHOD. (A PROJECT REPORT OF THE SOVIET-AMERICAN WORKING GROUP)

A. Ye. Basharinov and A. M. Shutko Washington NASA Feb. 1977 12 p refs Transl. into ENGLISH of "Itogi issledovaniy vlazhnosti gruntov SVCh radiometricheskim metodom (Proyekt otcheta sovetsko-amerikanskoy rabockey gruppy)" (unpublished work), Moscow, Acad. of Sciences USSR, Inst. of Radio Engineering and Electronics, 1976 p 1-11
(Contract NASw-2791)
(NASA-TT-F-17522) Avail: NTIS HC A02/MF A01 CSCL 08M

Research in the U.S.A. and the U.S.S.R. has established important properties of the superhigh frequency radiometric method of determining the moisture in soils. The theoretical, laboratory, field, and aircraft investigations are described. Author

N77-18541# California Univ., Riverside. Inst. of Geophysics and Planetary Physics.
PETROLOGY AND GEOCHEMISTRY OF HYDROTHERMAL ALTERATION IN BOREHOLE MESA 6-2, EAST MESA GEOTHERMAL AREA, IMPERIAL VALLEY, CALIFORNIA M.S. Thesis
James Robert Hoagland Jun. 1976 102 p refs
(Grant NSF AER-72-03551)
(PB-258871/3; IGPP-URC-76-12; NSF/RA-760235) Avail: NTIS HC A06/MF A01 CSCL 08I

Geothermal borehole Mesa 6-2 pentrates 6,000 ft. (1,830 m.) of interbedded sandstone and finer-grained sediment of the Colorado River Delta. Petrologic studies of recovered well cuttings show that the distribution of hydrothermal minerals essentially defines the vertical extent of the geothermal reservoir. A diffuse upper boundary of hydrothermal alteration underlies a thick section of clay-rich sediment. The clay-rich strata constitute a barrier to vertical flow of underlying thermal fluids. Thermochemical evaluation of the distribution of aqueous species in the Mesa 6-2 production fluid combined with the observed sequence of postdepositional alteration shows that the reservoir rocks have been subject to two distinct alteration events. The first involved potassium-silica metasomatism. Silica cementation inhibited continued flow of the initial fluid through the Mesa 6-2 aquifers, and cooler dilute water entered the system. Heating of the latter water caused precipitation of calcite and dissolution of quartz. This dilute fluid is presently produced from the 6-2 borehole. GRA

N77-18542*# Transemantics, Inc., Washington, D.C.
THE EARTH'S RAINBOW
V. Beletskaya, Ya. L. Ziman, and Yu. M. Chesnokov Washington NASA Feb. 1977 15 p Transl. into ENGLISH from Ogonek (Moscow), v. 3, Jan. 1977 p 16-17
(Contract NASw-2792)
(NASA-TT-F-17525) Avail: NTIS HC A02/MF A01 CSCL 14E

Color photographs from the Soviet Soyuz-22 Spacecraft are published for the first time in this edition. The photography was carried out by means of a multispectral band camera jointly developed by specialists of the Soviet Union and the German Democratic Republic. Various methods of photographing the earth, including microwave and radiothermal photography, and the various types of data which can be obtained by studying such photographs and the application of such data to economic benefit are discussed. The Raduga experiment shows that a study of the Earth from space is a complex technical problem, for whose solution the coordination of specialists in the most diverse branches of science and technology is required. Author

N77-18543# Oak Ridge National Lab., Tenn.
APPLICATION OF THE ORRMIS GEOGRAPHICAL DIGITIZING AND INFORMATION SYSTEM USING DATA FROM THE CARETS PROJECT
Charles R. Meyers, Jr., Donald L. Wilson, and Richard C. Durfee Apr. 1976 109 p refs Sponsored in part by NSF
(Contract W-7405-eng-26)
(ORNL-RUS-12) Avail: NTIS HC A06/MF A01

Spatial land-use and census-tract data are utilized to illustrate the Regional Environmental Systems Analysis (RESA) program's data digitization, information processing, and display techniques, for the Oak Ridge Regional Modeling Information System (ORRMIS) geographical data system. A standard display format is used that satisfies the requirements of the International Geographical Union (IGU) spatial encoding experiment. This format consists of spatial data display at the original source map scale and tabular compilation of area measurements of land use by census tract. The ORRMIS scanning-digitizing system is described, including data preparation, mechanical scanning, editing, and hierarchical cell assignment techniques, and the description is illustrated with computer-generated line printer and mechanical plotter displays. The system also has CRT plotter capability. ERA

N77-18544*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT: US STANDARD CATALOG, 1-31 DECEMBER 1976
31 Dec. 1976 86 p
(NASA-TM-X-74339; GSFC/LU-76/012;
NTISUB/B/138-76/012) Avail: NTIS HC A05/MF A01 CSCL 05B

The U.S. Standard Catalog lists U.S. imagery acquired by LANDSAT 1 and LANDSAT 2 which has been processed and input to the data files during the referenced month. Data, such as date acquired, cloud cover and image quality are given for each scene. The microfilm roll and frame on which the scene may be found are also given. Author

N77-18545*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT: NON-US STANDARD CATALOG 1-31 DECEMBER 1976
31 Dec. 1976 145 p
(NASA-TM-X-74338; GSFC/LN-76/012;
NTISUB/B/139-76/012) Avail: NTIS HC A07/MF A01 CSCL 05B

The Non-U.S. Standard Catalog lists Non-U.S. imagery acquired by LANDSAT 1 and LANDSAT 2 which has been processed and input to the data files during the referenced month. Data, such as date required, cloud cover and image quality are given for each scene. The microfilm roll and frame on which the scene may be found are also given. Author

N77-18546# General Electric Co., Daytona Beach, Fla.
PERSPECTIVE DISPLAY SIMULATION OF TERRAIN Final Report, Apr. - Dec. 1975
W. Marvin Bunker and Robert A. Heartz Brooks AFB, Texas AFHRL Jun. 1976 177 p refs
(Contract F33615-75-C-5243; AF Proj. 1958)
(AD-A030405; AFHRL-TR-76-39) Avail: NTIS HC A09/MF A01 CSCL 09/5

The ever-expanding utilization of electro-optical viewing systems (EVS) requires display simulation which validly depicts the contour or relief characteristics of terrain, rather than merely man-made objects on a flat surface. Such simulation will also be of great value in visual scene simulation. The data preparation techniques and computational algorithms of existing visual scene simulation systems using computer image generation (CIG) have been developed and optimized for man-made objects - hangars, houses, aircraft, carriers, etc. Earlier EVS simulation effort has used these techniques and algorithms. They are not optimum for terrain display. The effort covered in this report included preparation of simulation data bases from the digitized data prepared by the Defense Mapping AGency. Scenes were generated using several techniques for data compression. The General Electric CIG algorithm was modified to eliminate the constraint that faces be formed into convex objects - a highly artifical constraint for terrain faces. Scenes were generated using both visual and EVS processing. A radar display simulation system was modified to produce perspective displays, and scenes were generated from the DMA derived data bases. A comparative analysis of the radar approach versus the CIG approach was prepared, with a detailed definition of the constraints associated with the radar approach. Some of the simulated scenes were correlated with scenes from a movie made during a flight over the test area. Finally, an analysis concluded that scenes such as those generated can be produced in real-time by currently available CIG hardware. Author (GRA)

N77-18547# California Univ., Santa Cruz. Coastal Marine Studies Committee.
PROCEEDINGS OF A SYMPOSIUM ON OFFSHORE OIL

POTENTIAL AND RELATED LAND USE IMPACTS IN THE CENTRAL CALIFORNIA COASTAL ZONE
William T. Doyle, ed. 8 Jun. 1975 86 p Conf. Proc. held at Santa Cruz, Calif., 8 Jun. 1975 Sponsored in part by Assoc. of Monterey Bay Area Governments, Calif.
(Grant NOAA-04-5-158-30)
(PB-259074/3; NOAA-76071410; SP-3) Avail; NTIS HC A05/MF A01 CSCL 08I

The following topics are discussed: Tectonic and basin development of the Central California Coastal Area; Estimating potential oil resources in the Central California Coastal Zone; Offshore petroleum extraction and onshore facilities; Potential land use conflicts resulting from offshore drilling in the Central California Coastal Area; and Legal issues of regulating the coast. GRA

N77-18548# Geological Survey, Tallahassee, Fla. Water Resources Div.
HIGH-RESOLUTION SEISMIC REFLECTION PROFILING FOR MAPPING SHALLOW AQUIFERS IN LEE COUNTY, FLORIDA Final Report
Thomas M. Missimer and Richard A. Gardner Jul. 1976 36 p refs Prepared in cooperation with Florida State Dept. of Environmental Regulation, and County Commissioners of Lee County
(PB-259414/1; USGS-WRD-WRI-76-065; USGS-WRI-76-45) Avail: NTIS HC A03/MF A01 CSCL 08H

High-resolution continuous seismic reflection profiling equipment was used to define the configuration of sedimentary layers underlying part of Lee County, Florida. About 45 miles (72 kilometers) of profile were made on the Caloosahatchee River Estuary and San Carlos Bay. Two different acoustic energy sources, a high resolution boomer and a 45-electrode high resolution sparker, both having a power input of 300 joules, were used to obtain both adequate penetration and good resolution. The seismic profiles indicated that much of the strata of middle Miocene to Holocene age apparently are extensively folded but not faulted. GRA

N77-18549# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
ENERGY BALANCE AND RUNOFF FROM A SUBARCTIC SNOWPACK
Anthony G. Price, Thomas Dunne, and Samuel C. Colbeck Aug. 1976 41 p refs
(DA Proj. 4A1-61102-AT-24)
(AD-A030096; CRREL-76-27) Avail: NTIS HC A03/MF A01 CSCL 08/12

In Part I a physically based model was used to predict daily snowmelt on 2,000 m sq plots in the Subarctic. The plots had a range of aspects and inclinations in boreal forest and on the tundra. The energy balance, computed for each of the plots, was compensated for differences in radiative and turbulent energy fluxes caused by varied slope geometry and vegetative cover. The turbulent energy fluxes were also corrected for the effects of the stable stratification of the air over the snow surface. The predictions of the model were compared with daily melts derived from runoff measured on the snowmelt plots. The results show that the method is a good predictor of daily amounts of snowmelt, although some uncertainties are introduced by changes in the snow surface during the melt period. In Part II, a physically based model of the movement of water through snowpacks was used to calculate hydrographs generated by diurnal waves of snowmelt on the tundra and in the boreal forest of subarctic Labrador. The model was tested against measured hydrographs from hillside plots that sampled a range of aspect, gradient, length, vegetative cover, and snow depth and density. The model yielded good results, particularly in the prediction of peak runoff rates, though there was a slight overestimate of the lag time. A comparison of predictions against field measurements indicated that, given the ranges over which each of the controls is likely to vary, the two most critical factors controlling the hydrograph are the snow depth and the melt rate, which must be predicted precisely for short intervals of time. Permeability of the snowpack is another important control, but it can be estimated closely from published values. Author (GRA)

N77-18550# L N K Corp., Inc., Silver Spring, Md.
INTERACTIVE SCREENING OF RECONNAISSANCE IMAGERY Final Report, 1 Oct. 1974 - 31 Oct. 1975
George C. Stockman and Laveen N. Kanal Jun. 1976 124 p refs
(Contract F33615-75-C-5056)
(AD-A028969; AMRL-TR-76-15) Avail: NTIS HC A06/MF A01 CSCL 08/2

The general aims of this study were: (1) To relate symbolic map processing capabilities to capabilities for a reconnaissance imagery screening system; (2) To investigate structural pattern recognition techniques and the use of models for utilization in the segmentation and interpretation of imagery; and (3) To study man-machine task allocation in an interactive semiautomatic imagery screening system. As the study was to be theoretical, the results are in terms of recommendations and mathematical development and not in terms of any implementation. GRA

N77-18551# Army Engineer Topographic Labs., Fort Belvoir, Va.
THE STATE OF THE ART OF SLOPE MAPPING
Richard D. Sands Aug. 1976 17 p refs
(DA Proj. 4A7-62707-A-855)
(AD-A029443; ETL-0060) Avail: NTIS HC A02/MF A01 CSCL 08/2

The state of the art of slope mapping techniques is reviewed from the point of view of recommending one for adoption by the Army for use in the field by topographic battalions. A technique using a standard copy camera and an existing orbital lens device is selected as the most practical for field use. GRA

N77-18552# Harris Corp., Melbourne, Fla. Electro-Optics Operation.
INVESTIGATION OF CARTOGRAPHIC PRESSPLATE RECORDING FROM DIGITAL DATA Final Report, Oct. 1975 - Feb. 1976
Feb. 1976 139 p refs
(Contract DAAG53-76-C-0021)
(AD-A030158; ETL-0043) Avail: NTIS HC A07/MF A01 CSCL 08/2

This study was performed to determine the feasibility of recording cartographic pressplates directly from digital data. The principal technical aspects considered were laser recording technology and pressplate recording materials. The general conclusion was that, with certain qualifications, cartographic quality pressplates can be generated directly from digital data by laser recording with present and emerging technology. The generation of some form of a full color proof directly from digital data was found to be an essential function in any future system. Although there is a high potential for near term development of a full color proofing procedure compatible with direct pressplate recording from a digital data base, this feature merits particular attention in future developmental activities. Similarly, the candidate pressplate materials, while highly promising, must be more thoroughly characterized and compared in a subsequent program phase to establish practical performance levels, quality control, and availability. Author (GRA)

N77-18553# Harris Corp., Melbourne, Fla.
IMAGE MATCHED FILTER CORRELATOR EXPERIMENTS Final Technical Report, Jul. 1975 - Jun. 1976
F. B. Rotz Jul. 1976 113 p
(Contract F30602-75-C-0305; AF Proj. 5569)
(AD-A030025; RADC-TR-76-219) Avail: NTIS HC A06/MF A01 CSCL 08/2

The work described in this report is the continuation of the development of an automatic stereo compilation system based on coherent optical techniques. A breadboard coherent optical mapping system was modified to improve its accuracy and overall performance while at the same time simplifying the basic optics involved. Methods for preprocessing imagery to enhance correlation performance were studied and phase-type spatial filters were used to increase optical efficiency. The problem of data readout was investigated with particular attention to the use of an optical heterodyne technique. Computer and interface requirements for a fully automatic breadboard system were established and the use of real time filters was considered. Results indicate that this coherent optical system has considerable promise

in the area of parallax measurement and, with slight modification, may be a useful tool for feature extraction from aerial photographs. GRA

N77-18554# Mead Technology Labs., Dayton, Ohio.
DIGITAL DATA TO PRESSPLATE STUDY, TECHNICAL REPORT
Stephen Kelly 21 Apr. 1976 114 p refs
(Contract DAAG53-76-C-0022)
(AD-A030159; MTR-76-1; ETL-0044) Avail: NTIS HC A06/MF A01 CSCL 08/12

A technology survey to determine the status of the technology required to expose offset plates directly from digital data is presented. Digital printing systems, utilizing lasers as an exposing device are available but not with the necessary performance to satisfy DMA's needs. Offset plates that are compatible with laser exposing devices are currently available, but not in the format sizes required by DMA. Author (GRA)

N77-18555# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
PROCEDURES FOR THE SYSTEMATIC EVALUATION OF REMOTE SENSOR PERFORMANCE AND QUANTITATIVE MISSION PLANNING Ph.D. Thesis Final Report
Lewis E. Link, Jr. Aug. 1976 292 p refs
(DA Proj. 4A1-62121-A-896)
(AD-A030728; WES-TR-M-76-8) Avail: NTIS HC A13/MF A01 CSCL 17/5

Effective application of remote sensing techniques to civil engineering and environmental problems requires the selection of the sensor systems that will best provide the information desired. Because of the many phenomena involved and the lack of a simple means to consider them collectively, planning remote sensing missions has been done subjectively, quantitatively on a piecemeal basis, or solely on the experience of the investigator. None of these offers a systematic means to optimize the mission for acquisition of specific information types as a function of the many variables involved. The purpose of this study was to (a) quantitatively examine the natural phenomena that influence the information content of remote sensing imagery obtained in the visible and infrared (IR) portions of the electromagnetic spectrum, and (b) from the knowledge gained through these examinations, develop analytical tools for planning remote sensing missions and provide guidance for application of photographic and thermal IR sensor systems to civil engineering and environmental problems. This study consisted of (a) the development of analytical models that allow systematic control of the major variables that influence the character of imagery produced by photographic and thermal IR scanning sensor systems, and (b) formulation from the models of simple, but comprehensive, tools for planning photographic and thermal IR remote sensing missions. GRA

N77-18556*# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
REMOTE SENSING OF LAND USE AND WATER QUALITY RELATIONSHIPS - WISCONSIN SHORE, LAKE MICHIGAN
R. K. Haugen and T. L. Marlar Aug. 1976 55 p refs Sponsored in part by NASA
(NASA-CR-149449; AD-A030746; CRREL-76-30) Avail: NTIS HC A04/MF A01 CSCL 14/5

This investigation assessed the utility of remote sensing techniques in the study of land use-water quality relationships in an east central Wisconsin test area. The following types of aerial imagery were evaluated: high altitude (60,000 ft) color, color infrared, multispectral black and white, and thermal; low altitude (less than 5000 ft) color infrared, multispectral black and white, thermal, and passive microwave. A non-imaging hand-held four-band radiometer was evaluated for utility in providing data on suspended sediment concentrations. Land use analysis includes the development of mapping and quantification methods to obtain baseline data for comparison to water quality variables. Suspended sediment loads in streams, determined from water samples, were related to land use differences and soil types in three major watersheds. A multiple correlation coefficient R of 0.85 was obtained for the relationship between the 0.6-0.7 micrometer incident and reflected radiation data from the hand-held radiometer and concurrent ground measurements of suspended solids in streams. Applications of the methods and baseline data developed in this investigation include: mapping and quantification of land use; input to watershed runoff models; estimation of effects of land use changes on stream sedimentation; and remote sensing of suspended sediment content of streams. High altitude color infrared imagery was found to be the most acceptable remote sensing technique for the mapping and measurement of land use types. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N77-18557*# Florida Univ., Gainesville. Dept. of Electrical Engineering.
STUDIES OF SILICON p-n JUNCTION SOLAR CELLS Final Technical Report, 24 Jul. 1975 - 23 Jul. 1976
Fredrik A. Lindholm 23 Jul. 1976 124 p refs
(Grant NsG-3018)
(NASA-CR-149669) Avail: NTIS HC A06/MF A01 CSCL 10A

Single crystal silicon p-n junction solar cells made with low resistivity substrates show poorer solar energy conversion efficiency than traditional theory predicts. The physical mechanisms responsible for this discrepancy are identified and characterized. The open circuit voltage in shallow junction cells of about 0.1 ohm/cm substrate resistivity is investigated under AMO (one sun) conditions. Author

N77-18558*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MSFC SOLAR SIMULATOR TEST PLANE UNIFORMITY MEASUREMENT
Donald B. Griner Dec. 1976 64 p refs
(NASA-TM-X-73364) Avail: NTIS HC A04/MF A01 CSCL 10A

The equipment and procedure used to measure the test plane uniformity produced by the MSFC 405 lamp solar simulator array are described along with details of the computer program used to analyze the measurement data. The results of the first measurement show the uniformity not to be as good as expected. The best uniformity obtained had a standared deviation of 4 percent with peak-to-peak values of + or - 11 percent. Author

N77-18559*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EVALUATION OF QUASI-SQUARE WAVE INVERTER AS A POWER SOURCE FOR INDUCTION MOTORS
Buddy V. Guynes, Roger L. Haggard, and John R. Lanier, Jr. Washington Feb. 1977 35 p refs
(NASA-TN-D-8435; M-212) Avail: NTIS HC A03/MF A01 CSCL 10B

The relative merits of quasi-square wave inverter-motor technology versus a sine wave inverter-motor system were investigated. The empirical results of several tests on various sizes of wye-wound induction motors are presented with mathematical analysis to support the conclusions of the study. It was concluded that, within the limitations presented, the quasi-square wave inverter-motor system is superior to the more complex sine wave system for most induction motor applications in space. Author

N77-18560*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FORMULATED PLASTIC SEPARATORS FOR SOLUBLE ELECTRODE CELLS Patent Application

Dean W. Sheibley, inventor (to NASA) Filed 10 Mar. 1977 22 p
(NASA-Case-LEW-12358-1; US-Patent-Appl-SN-776146) Avail: NTIS HC A02/MF A01 CSCL 10C

A rubber ion transport sheeting material formulated with or without a flexible and porous substrate is described for use as the membrane between the acid compartments of a redox couple in a bulk electrical energy storage system. The membrane exhibits minimal increases in resistivity with the passage of time and prevents the accumulation of unequal amounts of water between the two sides of the redox cell. NASA

N77-18561# Massachusetts Univ., Amherst. Energy Alternatives Program.
INVESTIGATION OF THE FEASIBILITY OF USING WIND-POWER FOR SPACE HEATING IN COLDER CLIMATES. THE FINAL DESIGN AND MANUFACTURING PHASE OF THE PROJECT Quarterly Progress Report, Sep. - Dec. 1975
A. Chajes, A. Costa, D. E. Cromack, G. Darkazalli, F. J. Dzialo, R. M. Glorioso, W. E. Heronemus, C. A. Johnson, F. C. Kaminsky, R. H. Kirchhoff et al Dec. 1975 165 p refs Sponsored in part by ERDA
(Grant NSF AER-75-00603)
(ERDA/NSF/00603-75/T1; QPR-3) Avail: NTIS HC A08/MF A01

Progress during the third quarter was inadequate. System design and cost analysis are summarized. GRA

N77-18562# California Univ., Livermore. Lawrence Livermore Lab.
GEOLOGY AND POTENTIAL USES OF THE GEOPRESSURE RESOURCES OF THE GULF COAST
J. H. Howard, P. A. House, P. M. Johnson, D. F. Towse, D. G. Bebout (Texas Univ., Austin), M. H. Dorfman (Texas Univ., Austin), O. K. Agagu (Texas Univ., Austin), C. D. Hornburg (DSS Engineers, Inc.), and O. J. Morin (DSS Engineers, Inc.) Jun. 1976 21 p refs Presented at the 1976 Annual Convention of the Am. Assoc. of Petroleum Geologists, New Orleans
(Contract W-7405-eng-48)
(UCID-17163) Avail: NTIS HC A02/MF A01

This program has emphasized finding significantly large sand bodies within the geopressured stratigraphic section in addition to defining the distribution of abnormal fluid pressures and formation temperatures. Regional sand facies analyses conducted thus far indicate five locations in the Frio formation of Central and South Texas where adequately large geopressured geothermal resources may be present. Engineering studies of energy-conversion systems based on total-flow, flashed-steam, and binary-cycle concepts show that development of electric power from the Gulf Coast geopressure resource is technically feasible. Study of use of the resource as process heat in pulp and paper mills and new sugar refineries has shown that these uses also are technically sound. ERA

N77-18563# Argonne National Lab., Ill.
LIQUID METAL ELECTRODES IN SECONDARY BATTERIES
R. K. Steunenberg 1976 9 p refs Presented at Intern. Conf. on Liquified Metal Technol. in Energy Production, Champion, Pennsylvania, 3 May 1976
(Contract W-31-109-eng-38)
(CONF-760503-10) Avail: NTIS HC A02/MF A01

The present effort is directed mainly toward cells with solid lithium alloy (e.g., Li-Al, Li-Si) negative electrodes and metal sulfide positive electrodes. The current research and development work on sodium electrode batteries involves a liquid sodium electrode; a solid, ion-conducting electrolyte; and a liquid sulfur or metal chloride positive electrode. Both types of systems show promise for the electric automobile and load leveling applications. ERA

N77-18564# Southwest Research Inst., San Antonio, Tex.
DEVELOPMENT OF AN ASSESSMENT METHODOLOGY FOR GEOPRESSURED ZONES OF THE UPPER GULF COAST BASED ON A STUDY OF ABNORMALLY PRESSURED GAS FIELDS IN SOUTH TEXAS Progress Report, 1 Mar. - 31 May 1976
R. K. Swanson, P. Oetking, J. S. Osoba, and R. C. Hagens May 1976 24 p
(Contract E(11-1)-2687)
(COO-2687-4) Avail: NTIS HC A02/MF A01

Effort during the quarter was directed toward (1) locating drillstem and production test results from geopressured formations, (2) determining formation parameters in an additional large number of producing wells, and (3) searching production records for assessment of geopressured production in Brooks and Kenedy Counties. Several unsuccessful completion tests of geopressured water sands (attempted as gas completions) were located, and these give insight into the problems of completing high-volume water wells in that zone. Permeability calculations for a large number of geopressured and normally pressured gas wells throughout the study area were completed. In no case has a producing Rio Grande Valley gas well deeper than 10,000 ft. been identified with effective permeability as great as 10 md. Preliminary investigation of Brooks County production located geopressured production in seven gas fields and in North Kenedy County, an additional three. ERA

N77-18565# General Atomic Co., San Diego, Calif.
ENGINEERING DESIGN OF A THERMOCHEMICAL WATER-SPLITTING CYCLE Final Report
J. Degraaf, L. Halvers, J. Porter, and J. Russell 26 Mar. 1976 102 p refs
(Contract E(04-3)-167)
(GA-A-13726) Avail: NTIS HC A06/MF A01

Conceptual solutions for separation and recycle processes were developed and combined with the primary reactions to prepare a complete flow sheet and heat and mass balances, including coupling to a high-temperature gas-cooled reactor heat source. Major equipment items were sized from the flow sheet and used as the basis for a first-order cost estimate. The nonoptimized thermal efficiency is 27 percent. For the flow sheet as developed, the chemical plant costs are heat-exchange dominated and of the order of 3.5 times the cost of the nuclear heat source. Areas offering potential process improvement and/or requiring further experimental or analytical investigation are identified and discussed. ERA

N77-18566# Oak Ridge National Lab., Tenn.
BALANCED PROGRAM PLAN. VOLUME 4: COAL CONVERSION
C. R. Richmond, D. E. Reichle, and C. W. Gehrs May 1976 316 p refs
(Contract W-7405-eng-26)
(ORNL-5123-Vol-4) Avail: NTIS HC A14/MF A01

A description of the biomedical and environmental research necessary to ensure the timely attainment of coal conversion technologies amenable to man and his environment are presented. The document is divided into three sections. The first deals with the types of processes currently being considered for development; the data currently available on composition of product, process and product streams, and their potential effects; and problems that might arise from transportation and use of products. Section II is concerned with a description of the necessary research in each of the King-Muir categories, while the third section presents the research strategies necessary to assess the potential problems at the conversion plant (site specific) and those problems that might effect the general public and environment as a result of the operation of large-scale coal conversion plants. ERA

N77-18567# Argonne National Lab., Ill.
DEVELOPMENT OF NONDESTRUCTIVE EVALUATION METHODS FOR COAL-CONVERSION SYSTEMS
W. A. Ellingson, G. C. Stanton, and N. P. Lapinski 1976 12 p Presented at Symp. on Prevent. of Failures in Coal Conversion Systems, Columbus, Ohio, 21-23 Apr. 1976
(Contract W-31-109-eng-38)
(CONF-760472-2) Avail: NTIS HC A02/MF A01

Coal-conversion processes require the handling and containment of high pressure, high temperature, corrosive and erosive gases and liquids often containing particulate loadings. These severe environments cause materials failures that reduce successful and long-time operation of coal-conversion systems. The determination of the material and component response and development calls for proper nondestructive examination methods,

equipment, and techniques. Briefly described are the nondestructive development efforts in high-temperature, wall-thickness measurements for in-situ erosion data, passive infrared imaging applications for thermal profiles, gamma radiographic applications for crack and erosion detection and acoustic methods for failure prediction. ERA

N77-18568# Oak Ridge National Lab., Tenn.
COAL TECHNOLOGY PROGRAM Quarterly Progress Report, period ending 31 Mar. 1976
Jul. 1976 134 p refs
(Contract W-7405-eng-26)
(ORNL-5159) Avail: NTIS HC A07/MF A01

Progress in coal research programs was made in the following areas: coal gasification and coal liquefaction (hydrocarbonization, residue carbonization, solids removal from coal liquids, pyrolysis, in-situ gasification synthoil process, analytical chemistry (of by-products, effluents, etc.), environmental effects (including study of carcinogens, mutagens, etc.), trace elements, materials technology, nondestructive testing, chemical research, and possible applications of process heat reactors. ERA

N77-18569# DSS Engineers, Inc., Fort Lauderdale, Fla.
PRELIMINARY RESEARCH ON OCEAN ENERGY INDUSTRIAL COMPLEXES
C. D. Hornburg, B. Lindal, and N. El-Ramly 1976 24 p Presented at Joint Conf. of the Am. Sect. of the Intern. Solar Energy Soc. and the Solar Energy Soc. of Can., Winnipeg, Canada, 15-20 Aug. 1976 Sponsored by ERDA
(CONF-760821-2) Avail: NTIS HC A02/MF A01

Results of a one year study on the feasibility of producing energy intensive products at ocean sites using electricity generated from ocean thermal energy conversion (OTEC) plants are presented. Analysis of production methods and other data on 62 major products led to selecting 23 of these for further study. Production was grouped into five separate, possible complexes. Further market and transportation studies showed that production of products in a sea chemicals complex and an organic chemicals and plastics complex had the highest economic potential. An environmental assessment revealed that these complexes would have no adverse environmental impact. The selected products can be produced at ocean sites competitively with production at similar land-based complexes. Return on investment will be between 13 and 18 percent depending on actual power costs and details of the final designs. ERA

N77-18570# Martin Marietta Corp., Denver, Colo.
CENTRAL RECEIVER SOLAR THERMAL POWER SYSTEM, PHASE 1 Progress Report, period ending 31 Dec. 1975
Apr. 1976 486 p refs
(Contract E(04-3)-1110)
(SAN-1110-76-TI; MCR-76-121) Avail: NTIS HC A21/MF A01

The program objective is the preliminary design of a 10 MWe pilot solar power plant supported by major subsystem experiments. Progress is reported on the following task elements: 10 MWe pilot plant; collector subsystem design and analysis; receiver subsystem requirements; receiver subsystem design; thermal storage subsystem; electrical power generation subsystem; and pilot plant architectural engineering and support. ERA

N77-18571# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
SOLAR PILOT PLANT, PHASE 1 Quarterly Report, Jul. - Dec. 1975
20 Feb. 1976 115 p
(Contract E(04-3)-1109)
(SAN-1109-76-TI; QR-1) Avail: NTIS HC A06/MF A01

A preliminary design baseline for a 10-MW(e) solar pilot plant was generated and analyzed. Subsequently, several changes were made to improve performance and/or reduce cost. Conceptual designs and research experiments were generated for three key subsystems - collector, steam generator, and thermal storage. Limited testing was done to study the problem of removing eutectic salts from vaporizer tubes in the thermal storage subsystem. The program was on schedule at the end of 1975. ERA

N77-18572# Energy Research and Development Administration, Washington, D.C.
UTILIZATION OF SOLAR ENERGY
Werner Kleinkauf 1976 17 p Transl. into ENGLISH from German Report Submitted for publication Sponsored in part by Federal Ministry for Research and Technology
(ERDA-tr-144) Avail: NTIS HC A02/MF A01

The production of high-temperature heat in the Federal Republic of Germany is not cost effective owing to the availability of a duration of sunshine of ca. 1500 h/a. The substitution of previous energy carriers for production of low-temperature heat, nevertheless, is also still available at these latitudes. Especially suited for this are decentralized units with flat collector systems for supplying single and two-family houses. If higher solar energy yields are required owing to the shortage as well as the steadily increasing costs of previous energy carriers or owing to ecological viewpoints, it follows that sunny regions of the south become involved as locations for solar power plants. If the regions of North Africa are included in the considerations, it follows that there is a considerably large energy potential available which could cover the energy requirement of the Federal Republic of Germany as well as that of Western Europe. ERA

N77-18573# California Univ., Berkeley. Lawrence Berkeley Lab.
FERMENTATION KINETICS AND PROCESS ECONOMICS FOR THE PRODUCTION OF ETHANOL
Gerald Raymond Cysewski and Charles R. Wilke Mar. 1976 293 p refs
(Contract W-7405-eng-48)
(LBL-4480) Avail: NTIS HC A13/MF A01

A cell recycle system employing an external settler to increase the biomass concentration in continuous fermentations was examined. In addition, a novel vacuum fermentation scheme was developed whereby ethanol is boiled away from the fermentation broth as it is produced. By combining the vacuum fermentation with cell recycle, yeast cell densities of 124 g dry wt/1 were achieved resulting in a 14-fold increase in ethanol productivity over simple continuous operation. From the experimental results obtained industrial size ethanol fermentation plants were designed and an economic evaluation conducted. The process design studies indicated that over a 50 percent reduction in capital expenditure may be obtained by continuous rather than batch operation. Further reductions in processing costs were achieved by both cell recycle and vacuum operation. However, the cost of fermentable substrate, either molasses or enzymatic hydrolysate sugars, dominates the economics of ethanol production. ERA

N77-18574# Sandia Labs., Albuquerque, N.Mex.
ECONOMIC STUDY OF SOLAR TOTAL ENERGY
R. W. Harrigan 1976 15 p refs Sponsored by ERDA
(SAND-76-5291; Conf-760821-1) Avail: NTIS HC A02/MF A01

The application of solar total energy to a 2,000-dwelling unit mixed-load community is investigated. The community design is consistent with current community planning practices. An energy analysis of the community was performed, and a solar total energy system sized to meet the community demands. The economics of providing a solar total energy system is examined. The effect of dwelling unit density is examined. ERA

N77-18575# California Univ., Livermore. Lawrence Livermore Lab.
DEVELOPMENT SCENARIO FOR LASER FUSION
J. A. Maniscalco, J. Hovingh, and R. R. Buntzen 30 Mar. 1976 57 p refs Presented at the Meeting of the Am. Nucl. Soc., San Francisco, 16 Nov. 1975 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-76980; Conf-751101-91) Avail: NTIS HC A04/MF A01

The relevant engineering and economic aspects of research and development facilities are discussed. Pellet design and gain predictions corresponding to the most promising laser systems are presented for each plant. The results show that laser fusion has the potential to make a significant contribution to our energy needs. Beginning in the early 1990's, this new technology could be used to produce fissile fuel, and after the turn of the century it could be used to generate electrical power. ERA

N77-18576# Sandia Labs., Albuquerque, N.Mex.
STATUS OF THE ERDA/SANDIA 17-METRE DARRIEUS TURBINE DESIGN
Ben F. Blackwell 1976 8 p Presented at Intern. Symp. on Wind Energy Systems, Cambridge, England, 7 Sep. 1976
(Contract AT(29-1)-789)
(SAND-76-5683; Conf-760909-2) Avail: NTIS HC A02/MF A01

The present status of the ERDA/Sandia Laboratories 17-meter Darrieus turbine design is summarized. ERA

N77-18577# Sandia Labs., Albuquerque, N.Mex.
LOW-COST BLADE DESIGN CONSIDERATIONS
L. V. Feltz 1976 38 p Presented at the Vertical-Axis Wind Turbine Technol. Workshop, Albuquerque, New Mex., 17 May 1976 Sponsored by ERDA
(SAND-76-5535; Conf-760551-1) Avail: NTIS HC A03/MF A01

Attempts to identify and continually upgrade blade designs for a 17 meter wind turbine design are described. The goal is to establish several low-cost blade designs. ERA

N77-18578# Oklahoma Univ., Norman. School of Chemical Engineering and Materials Science.
ECONOMIC EVALUATION OF MIXTURE AND PURE FLUID CYCLES IN OCEAN THERMAL ENERGY CONVERSION SYSTEMS M.S. Thesis
Carl Anthony Lawson 30 Apr. 1976 144 p refs
(Contract E(40-1)-4918)
(ORO-4918-8) Avail: NTIS HC A07/MF A01

The results of this research study indicate that the heat exchangers are the principal contributors to the capital cost of the ocean thermal power plant. The sensitivity analysis performed in this research study showed that there are several economic trade-offs associated with the design and performance of the heat exchangers. The trade-offs include such items as the cold water pipe length, the sea water temperature rise and velocity. It was observed that mixtures provide an increasing economic advantage over pure fluids as the temperature rise in the cold sea water is increased. It is postulated that significant economic savings can be experienced with the use of mixtures if the cost of the heat exchanger can be reduced by one-half its present cost. ERA

N77-18579# General Electric Co., Philadelphia, Pa. Space Div.
GENERAL ELECTRIC COMPANY STUDY FOR DEFINING THE NUMBER OF RESIDENTIAL AND NON-RESIDENTIAL PROJECTS, NATIONAL SOLAR DEMONSTRATION PROGRAM
Apr. 1976 17 p
(Contract E(11-1)-2683)
(COO-2683-76/7) Avail: NTIS HC A02/MF A01

The methodology used to perform the parametric study to define a recommended demonstration program involved a decision making process. In this approach, selective solar buying factors were quantitatively evaluated for influencing key decision makers to install solar HVAC equipment. The selection of the recommended demo level also considered the probability of a decision maker actually seeing a demonstration as a function of how far he is located from a demo and how far he is willing to travel to see one. Demonstration levels of 200, 400, 800, 1,600 and 3,200 were assumed to determine the effects on Solar HVAC market penetration. The 800 demo level program is recommended to effectively stimulate the private sector to install solar HVAC systems. ERA

N77-18580# Delaware Univ., Newark. Inst. of Energy Conversion.
SOLAR ONE DATA ACQUISITION Interim Progress Report
25 Mar. 1976 37 p
(Contract E(11-1)-2589)
(COO-2589-1) Avail: NTIS HC A03/MF A01

Solar One has been instrumented with sensors for weather data system temperatures and pressures, house electrical loads, and photovoltaic system data. An automatic data acquisition and handling system has been designed and installed to gather and then transmit data to a central computer. Programs to summarize these data and tabulate them in convenient forms have been prepared. Initial data have been obtained and analyzed to check the sensor system and to give preliminary performance characteristics of the solar system. ERA

N77-18581# Battelle Pacific Northwest Labs., Richland, Wash.
OCEAN THERMAL ENERGY CONVERSION OPPORTUNITIES
L. D. Perrigo and G. A. Jensen May 1976 31 p refs Symp. on Energy Alternatives, Richland, Wash., 15 May 1976
(Contract E(45-1)-1830)
(BNWL-SA-5808; Conf-760549-1) Avail: NTIS HC A03/MF A01

The thermodynamic efficiencies of the process were found to be very low, and methods for preventing film deposits are mandatory. Heat transfer cannot realistically be improved by increasing pump rates or heat transfer surfaces because of intolerable parasitic power demands or capital expenditures. The development and use of power plants also have political implications that must be accommodated. Operation of such systems must be reconciled with various international agreements, the needs of marine navigation, and national defense requirements. ERA

N77-18582# Joint Center for Graduate Study, Richland, Wash.
INVESTIGATION OF LOW COST SOLAR CELLS BASED ON Cu2O Semiannual Report, 1 Oct. - 31 Mar. 1976
Larry C. Olsen May 1976 62 p refs
(Grant NSF AER-75-20501)
(PB-258583/4; NSF/RANN/AER75-20501/PR-76-1) Avail: NTIS HC A04/MF A01 CSCL 10B

A system was established for controlled oxidation of copper involving a quartz tube heated by an automatically controlled tube furnace, and subjected to an oxygen-nitrogen mixture to oxidize copper. Cu2O films typically have grain sizes greater than 100 micrometers. Thin-film cells have been fabricated with a Cu2O thickness in the range of 2-5 micrometers. Collection efficiency is measured with a high intensity Bausch and Lomb monochromator. After determining the reflection coefficient for a given wavelength, measurement of short-circuit current allows the absolute collection efficiency to be determined. GRA

N77-18583# Joint Center for Graduate Study, Richland, Wash.
INVESTIGATION OF LOW COST SOLAR CELLS BASED ON Cu2O Quarterly Progress Report, 1 Apr. - 30 Jun. 1976
Larry C. Olsen Aug. 1976 33 p refs
(Grant NSF AER-75-20501)
(PB-258746/7; NSF/RANN/AER75-20501/PR-76-2) Avail: NTIS HC A03/MF A01 CSCL 10B

Three approaches have been used to form an ohmic contact to Cu2O: evaporation of Cu, evaporation of In2O3 and by a dipping process. Backwall cell efforts have concentrated on thin-film cell fabrication. Devices have been made with Cu2O layer thicknesses between 1 micrometer and 10 micrometers. The approach used for MIS solar cell calculations has been further improved. Calculations for Cu2O and other materials were done. GRA

N77-18584# Federal Energy Administration, Washington, D.C. Office of Regulation Development.
PROPOSED ENERGY CONSERVATION CONTINGENCY PLAN: EMERGENCY HEATING, COOLING AND HOT WATER RESTRICTIONS. ECONOMIC IMPACT ANALYSIS. ENVIRONMENTAL IMPACT ASSESSMENT Contingency Plan No. 1
Sep. 1976 303 p refs
(PB-258624/6; FEA/H-76/430) Avail: NTIS HC A14/MF A01 CSCL 10A

The economic and environmental impacts of a plan imposing emergency restrictions on heating, cooling, lighting, and hot water temperatures in public, commercial and industrial buildings are described. The proposed plan, as specified for the analysis, would affect an estimated five million buildings. GRA

N77-18585# Federal Energy Administration, Washington, D.C. Office of Regulation Development.
PROPOSED ENERGY CONSERVATION CONTINGENCY

PLAN: EMERGENCY COMMUTER PARKING MANAGEMENT AND CARPOOLING INCENTIVES. ECONOMIC IMPACT ANALYSIS. ENVIRONMENTAL IMPACT ASSESSMENT Contingency Plan No. 2
Sep. 1976 214 p refs
(PB-258625/3; FEA/H-76/431) Avail: NTIS HC A10/MF A01 CSCL 10A

The economic impact of a plan whose objective is to reduce demand for gasoline by restricting the availability of auto parking for commuters and encouraging commuters to form carpools or use mass transit during a supply interruption is described. GRA

N77-18586# Federal Energy Administration, Washington, D.C. Office of Regulation Development.
PROPOSED ENERGY CONSERVATION CONTINGENCY PLAN: EMERGENCY WEEKEND GASOLINE AND DIESEL FUEL RETAIL DISTRIBUTION RESTRICTIONS. ECONOMIC IMPACT ANALYSIS. ENVIRONMENTAL IMPACT ASSESSMENT Contingency Plan No. 3
Sep. 1976 262 p refs
(PB-258626/1; FEA/H-76/432) Avail: NTIS HC A12/MF A01 CSCL 10A

A description is given of the economic impact of the Emergency Weekend Gasoline, and Diesel Fuel Retail Distribution Restrictions Plan, which would reduce petroleum product demand by an estimated 160,000 barrels per day: 156,000 BD of gasoline and 4,000 BD of residual oil. GRA

N77-18587# Federal Energy Administration, Washington, D.C. Office of Regulation Development.
PROPOSED ENERGY CONSERVATION CONTINGENCY PLAN: EMERGENCY BOILER. COMBUSTION EFFICIENCY REQUIREMENTS. ECONOMIC IMPACT ANALYSIS. ENVIRONMENTAL IMPACT ASSESSMENT Contingency Plan No. 4
Sep. 1976 190 p refs
(PB-258627/9; FEA/H-76/433) Avail: NTIS HC A09/MF A01 CSCL 10A

A description is presented of the economic impact of the plan which would require increased combustion efficiency by selected boiler operators. The boilers affected by the plan are forced draft oil and natural gas fired industrial and commercial boilers. GRA

N77-18588# Federal Energy Administration, Washington, D.C. Office of Regulation Development.
PROPOSED ENERGY CONSERVATION CONTINGENCY PLAN: EMERGENCY RESTRICTIONS ON ILLUMINATED ADVERTISING AND CERTAIN GAS LIGHTING. ECONOMIC IMPACT ANALYSIS. ENVIRONMENTAL IMPACT ASSESSMENT Contingency Plan No. 5
Sep. 1976 221 p refs
(PB-258628/7; FEA/H-76/434) Avail: NTIS HC A10/MF A01 CSCL 10A

The economic impact of restrictions on the use of illuminated advertising and certain gas lighting is described. The proposed plan would reduce demand for electricity and natural gas. GRA

N77-18589# Grumman Aerospace Corp., Bethpage, N.Y.
SOLAR ASSISTED HEAT PUMP DEMONSTRATION PROJECT, PHASE 1 Final Report
Burt Swerdling 26 Oct. 1976 36 p refs Sponsored by N. Y. State Energy Res. and Develop. Authority
(PB-259289/7; NYSERDA-75/16) Avail: NTIS HC A03/MF A01 CSCL 13A

The design and construction of a solar assisted heat pump system are discussed along with the preparation of an instrumentation plan, instrumentation installation, and preliminary system checkout. GRA

N77-18590# Naval Research Lab., Washington, D.C.
NAVY APPLICATIONS FOR TERRESTRIAL PHOTOVOLTAIC SOLAR POWER Interim Report
R. L. Statler, G. K. Hubler, C. S. Guenzer, and B. J. Faraday Sep. 1976 39 p ref
(NRL Proj. H01-55; RR0120641)
(AD-A030529; NRL-MR-3363) Avail: NTIS HC A03/MF A01 CSCL 10/1

The U.S. Army Mobility Equipment Research and Development Center (MERDC), Fort Belvoir has been tasked by the Assistant Secretary of Defense (Installations and Logistics) with Energy Research and Development Administration (ERDA) funds to prepare a Department of Defense proposal for installing terrestrial solar photovoltaic power in DoD operational systems. This report describes a survey made by the Radiation Effects Branch of the Radiation Technology Division to identify specific terrestrial solar photovoltaic power applications appropriate to DoD operational systems and facilities. GRA

N77-18591# Mallory (P. R.) and Co., Inc., Burlington, Mass. Lab. for Physical Science.
SEALED PRIMARY LITHIUM - INORGANIC ELECTROLYTE CELL Quarterly Report, 1 Mar. - 31 May 1976
A. N. Dey Sep. 1976 43 p refs
(Contract DAAB07-74-C-0109; DA Proj. 1S7-62705-AH-94)
(AD-A029915; ECOM-74-0109-9; QR-9) Avail: NTIS HC A03/MF A01 CSCL 10/3

The objective of this program is to develop an all-inorganic electrolyte primary D cell which is storable and operable in the temperature range of -40 to 160 C and is capable of delivering in excess of 150 WHr/lb at the thirty hours rate and at a peak power density of 50 watts/lb. The hermetic Li/SOCl2 D cell developed by us met all the objectives in terms of fresh performance. However, on storage the cells displayed a voltage delay. In addition, the cells exhibited explosion hazards on abuse. The results to date are encouraging in that new approaches may be found to alleviate the voltage-delay problem based on the information on the growth and morphology of the anode film. GRA

N77-18592# Tetra Tech, Inc., Arlington, Va.
ENERGY FACT BOOK 1976, CHAPTERS 1 THROUGH 21
15 Jul. 1976 433 p refs
(Contract N00014-76-C-0239)
(AD-A028284; TETRAT-A-642-76-254) Avail: NTIS HC A19/MF A01 CSCL 10/1

The Energy Fact Book - 1976 summarizes the present U.S. Energy situation; Energy R and D Legislation; Federal Government Energy R and D; and Foreign Energy R and D. It includes a brief description of the various processes and developments related to hydrocarbon fuels, synthetic fuels, non-hydrocarbon energy sources and energy conservation. GRA

N77-18593# Universal Energy Systems, Inc., Dayton, Ohio.
ELECTROFLUID DYNAMICS ENERGY CONVERSION RESEARCH Final Report, 18 Mar. 1973 - 30 Jun. 1975
Ernest F. Fretter and Russell W. Griffith Dec. 1975 128 p refs
(Contract F33615-73-C-4053; AF Proj. 7116)
(AD-A029066; AFAPL-TR-76-35) Avail: NTIS HC A07/MF A01 CSCL 10/2

Electrofluid Dynamics (EFD) is a method of direct energy conversion in which the energy contained in a flowing gas is converted directly into electrical energy. This is generally accomplished by seeding the flowing gas with unipolar charged ions produced by a corona discharge from a sharp grounded electrode. The unipolar ions typically are deposited on particles usually produced by condensation of either a minor component (such as water vapor) of the flowing gas or by condensation of the flowing gas itself. The charged particles are then transported by viscous interaction with the flowing gas to the collector electrode of the generator where at high potential the particles release their charge to the collector. The current thus generated travels through a load to ground. Many references can be cited which describe the basic operation of various EFD generators; several are listed in the Bibliography. GRA

N77-18594# Bonneville Power Administration, Portland, Oreg.
PROCEEDINGS OF THE 3RD ANNUAL ENERGY CONSERVATION MANAGEMENT CONFERENCE Final Report
Mar. 1976 104 p refs Conf. Proc. held at Portland, Oregon, 18-19 Mar. 1976
(PB-258652/7) Avail: NTIS HC A06/MF A01 CSCL 10A

An array of addresses and papers covering various aspects of energy conservation is presented. Topics discussed are: energy management in buildings; heat recovery techniques; heat pumps;

energy conservation research and development; automobile energy conservation; and electric vehicles. GRA

N77-18595# Forest Service, Washington, D.C.
THE FEASIBILITY OF UTILIZING FOREST RESIDUES FOR ENERGY AND CHEMICALS Final Report
Mar. 1976 184 p
(Grant NSF AER-75-19464)
(PB-258630/3; NSF/RA-760013; FEA/G-76/435) Avail: NTIS HC A05/MF A01 CSCL 10A

A feasibility study of the Forest Industry Energy Program (FIEP), a major forest service effort to explore the use of wood residues to meet the energy requirements of individual forest industry operations within the forest land management environmental objectives, is reported. Direct energy conversion and chemical conversion are also discussed. GRA

N77-18596# Federal Energy Administration, Washington, D.C. Office of Economic Impact Analysis.
REPORT TO CONGRESS ON THE ECONOMIC IMPACT OF ENERGY ACTIONS Semiannual Report
Jun. 1976 64 p
(PB-257697/3; FEA/B-76/384) Avail: NTIS HC A04/MF A01 CSCL 05C

An inflationary impact evaluation is presented as an individual report of the likely impact on energy prices, the consumer price index, and other economic variables, of actions proposed by the administrator of FEA. GRA

N77-18597# National Science Foundation, Washington, D.C.
GEOTHERMAL ENERGY PROGRAM, CURRENT RESEARCH PROJECTS SUPPORTED BY THE NATIONAL SCIENCE FOUNDATION
Mar. 1976 40 p
(PB-258948/9; NSF/RA-760090) Avail: NTIS HC A03/MF A01 CSCL 10A

Research projects are described dealing with: Geosciences of geothermal resources; Advanced exploration technology; Geothermal reservoir engineering; Geothermal extraction technology; Geothermal environmental research; and legal and institutional studies. GRA

N77-18598# Oregon State Univ., Corvallis.
AERODYNAMIC PERFORMANCE OF WIND TURBINES
Robert E. Wilson, Peter B. S. Lissaman, and Stel. N. Walker Jun. 1976 170 p refs Prepared in cooperation with Aerovironment Inc., Pasadena, Calif.
(Grant NSF AER-74-04014-A03)
(PB-259089/1; NSF/RA-760228) Avail: NTIS HC A08/MF A01 CSCL 10A

The state-of-the-art of performance prediction methods is summarized for both horizontal and vertical axis wind turbines. Strip theory methods for horizontal axis wind turbines are evaluated for various tip loss models and occurrence of multiple solutions in strip theory analysis is discussed and illustrated. The performance of high-solidity turbines such as the Chalk design is also discussed. The configuration and performance of optimum horizontal axis wind turbines are addressed. Optimization schemes are developed and discussed and comparisons with the MOD-0 rotor are made. Performance at off-designed conditions is also examined. Performance prediction methods for vertical axis wind turbines are covered. Chapter 4 develops the performance model for the Darrieus Rotor. Chapter 5 contains an analytical model of the flow in a Savonius Rotor. GRA

N77-18599# Rutgers Univ., New Brunswick, N.J. Dept. of Electrical Engineering.
SILICON SCHOTTKY PHOTOVOLTAIC DIODES FOR SOLAR ENERGY CONVERSION Quarterly Progress Report, 1 Apr. - 30 Jun. 1976
Wayne A. Anderson Jul. 1976 28 p refs
(Grant NSF AER-73-03197)
(PB-258826/7; NSF/RANN/SE/AER73-03197/PR-76; NSF/RA-760204) Avail: NTIS HC A03/MF A01 CSCL 10B

A Schottky solar cell on silicon was constructed with Voc = 0.58 V by Cr deposition. Good agreement between experimental data and theoretical equations permits the correlation of n-factor, oxide thickness, surface-state density, metal work function, barrier height, and open-circuit voltage. Other studies have included Auger analysis, environmental effects, photovoltaic tests at NASA-Lewis, computer analysis, grid design, and solar simulation. GRA

N77-18600# United Technologies Research Center, East Hartford, Conn.
PRELIMINARY FEASIBILITY EVALUATION OF COMPRESSED AIR STORAGE POWER SYSTEMS Semiannual Technical Report
Albert J. Giramonti May 1976 306 p refs
(Grant NSF AER-74-00240)
(PB-259281/4; R76-952161-4; NSF/RA-760206; SATR-2) Avail: NTIS HC A14/MF A01 CSCL 21E

Conceptual system design studies and progress made during the second six months of this 18-month period are reported. Preliminary results are presented in Part 2 for the geological surveys being conducted for Phase 1. Preliminary results for the conceptual system design studies being conducted for Phase 2 are presented in Part 3. GRA

N77-18601# Stevens Inst. of Tech., Hoboken, N.J. Dept. of Mechanical Engineering.
HYDROGEN ENERGY CONVERSION Semiannual Report, 1 Feb. - 31 Jul. 1975
Richard B. Cole, Robert F. McAlevy, III, and Max Bentele 27 Jul. 1976 139 p refs
(Contract N00014-75-C-0220; ARPA Order 2615)
(AD-A030370; ' ME-RT-75009; SATR-3) Avail: NTIS HC A07/MF A01 CSCL 21/1

Air-breathing reciprocating engines and gas turbines fueled with hydrogen are treated with special concern for the problems each might encounter if used on a large scale. The potential improvements in performance of each power plant when operated with hydrogen are determined using prior analytical and experimental data and/or new estimates. Particular attention is given to factors which might improve conversion efficiency and discount, at least partially, the relatively high cost of hydrogen energy. Previous operating experience and analysis of gas-turbine operation on hydrogen are considered. Hydrogen-fueled gas turbines are found, unlike reciprocating engines, to offer relatively modest thermodynamic performance gain compared with hydrocarbon fueling, though LH2 fueling has substantial potential (undemonstrated) for power-plant efficiency or reliability improvement through hot-section cooling and/or heat regeneration. LH2 fuel-system problems with transient response as well as inavailability of suitable hardware are most evident, though probably resolvable by substantial state-of-the-art development. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N77-18602*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PROCEEDINGS OF THE SPACE SHUTTLE ENVIRONMENTAL ASSESSMENT WORKSHOP ON STRATOSPHERIC EFFECTS
Andrew E. Potter, comp. Jan. 1977 171 p refs Proc. of workshop held at NASA Lyndon B. Johnson Space Center, Houston, Tex., 24-25 Mar. 1976
(NASA-TM-X-58198) Avail: NTIS HC A08/MF A01 CSCL 13B

Various aspects of the potential environmental impact of space shuttle exhaust are explored. Topics include: (1) increased ultraviolet radiation levels in the biosphere due to destruction of atmospheric ozone; (2) climatic changes due to aerosol particles affecting the planetary albedo; (3) space shuttle propellants (including alternate formulations); and (4) measurement of space shuttle exhaust products. Author

N77-18603*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NASA GLOBAL ATMOSPHERIC SAMPLING PROGRAM

(GASP) DATA REPORT FOR TAPE VL0005
J. D. Holdeman and F. M. Humenik Feb. 1977 45 p refs
(NASA-TM-X-73608; E-9086) Avail: NTIS HC A03/MF A01 CSCL 13B

Atmospheric ozone, water vapor, and related flight and meteorological data were obtained during 214 flights of a United Airlines B-747 and two Pan American World Airways B-747's from March through June 1976. In addition, trichlorofluoromethane data obtained from laboratory analysis of two whole air samples collected in flight are reported. These data are available on GASP tape VL0005 from the National Climatic Center, Asheville, North Carolina. In addition to the GASP data, tropopause pressure fields obtained from NMC archives for the dates of the GASP flights are included on the data tape. Flight routes and dates, instrumentation, data processing procedures, and data tape specifications are described in this report. Selected analyses including ozone and sample bottle data are also presented.
Author

N77-18604# Pennsylvania Research Associates, Inc., Philadelphia.
FUNDAMENTALS OF NITRIC OXIDE FORMATION IN FOSSIL FUEL COMBUSTION Quarterly Progress Report, 11 Dec. - 10 Mar. 1976
Thomas Houser (Western Mich. Univ.) Apr. 1976 13 p refs
(Contract E(49-18)-2018)
(FE-2018-3) Avail: NTIS HC A02/MF A01

A study of the reactions which may lead to NO formation from fuel nitrogen was continued. The volatile products formed from the pyrolysis of pyridine in an inert atmosphere were found to be HCN, vinyl cyanide, benzene, acetylene, ethylene (very small amounts) and possibly diacetylene. Significantly, no evidence of acetonitrile was found. Mass spectrometric analysis of the nonvolatile tar which forms at the reactor exit, using a solid probe, indicated the presence of condensed-ring, heterocyclic aromatic and bipyridinyl groups. In addition, elemental analysis of the solid indicated that the relative nitrogen content decreased as the temperature of pyrolysis increased. Concurrently a study of the rate of oxidation of cyanogen was started using reaction times of 0.25 to 3.00 sec. and temperatures of 950 to 1000 C.
ERA

N77-18605# California Univ., Livermore. Lawrence Livermore Lab.
TRACE-ELEMENT EMISSIONS FROM WESTERN US COAL-FIRED POWER PLANTS
R. C. Ragaini and J. M. Ondov 2 Jul. 1976 11 p refs Presented at the 1976 Intern. Conf. on Modern Trends in Activation Analysis, Munich, 13-17 Sep. 1976
(Contract W-7405-eng-48)
(UCRL-77669; Conf-760915-1) Avail: NTIS HC A02/MF A01

It is shown that the particle-size distributions of trace elements in stack emissions are significantly different for two power plants, and also for two different emission control systems at the same power plant. The particle-size distributions are governed by the elemental volatility characteristics and the emission control systems. Generalizations are not valid in determining the potential inhalation effects from coal-fired power plants; the particular stack emissions of interest must be examined. Comparison of pulmonary deposition of several toxic particulate species from the two devices suggests that use of Venturi scrubbers as opposed to electrostatic precipitators for particulate emission control may result in increased potential for pulmonary exposure.
ERA

N77-18606# California Univ., Livermore. Lawrence Livermore Lab.
MAN'S IMPACT ON HIS GLOBAL ENVIRONMENT
J. B. Knox Jul. 1976 8 p refs Presented at Conf. on the Study of Democratic Inst., Santa Barbara, Calif., 9 Jul. 1976
(Contract W-7405-eng-48)
(UCID-17178; Conf-760721-1) Avail: NTIS HC A02/MF A01

There is a need to move towards a policy of conservation of our global air resources in its totality from earth's surface to stratosphere. The technical data base and level of understanding should be systematically improved for the rational implementation of standards for the whole atmosphere. The U.S. should establish a focal point for regional and global environmental assessments responsive to policy makers' needs and concerns, and interactive with the UN's global environmental monitoring system. The environmental consequences of increased U.S. dependence on coal should receive greater attention so that optimal choices between control technology, tall stacks, and synthetic fuels may be achieved with conservation of total air resources.
ERA

N77-18607# Illinois State Water Survey, Urbana.
STUDY OF AIR POLLUTION SCAVENGING Progress Report
R. G. Sermonin Apr. 1976 26 p refs
(Contract E(11-1)-1199)
(COO-1199-51; PR-14) Avail: NTIS HC A03/MF A01

The field experiments were continued to estimate convective storm particulate scavenging efficiency in proximity to the St. Louis, Missouri urban-industrial complex. Complementary studies of the urban aerosol characterization, source strength, and removal processes were also studied. The 1975 field effort shifted emphasis from the immediate St. Louis area to the Alton-Wood River industrial complex. Along with the change in size and configuration of the network, there were increases in the numbers of most types of samplers. The new network yielded the following types of samples for analysis and interpretation: 1,065 total rain samples from 85 sites; 68 sequential rainwater samples from 2 locations; 272 wet/dry samples from 7 locations; 216 air filter samples from 7 locations; 36 air filter samples from aircraft; and raindrop spectrometer data from 11 sites for the period 17 June-18 August.
ERA

N77-18608# European Space Agency, Paris (France).
EMISSIONS OF POLLUTANTS IN THE STRATOSPHERE
Marcel Barrere et al Dec. 1975 132 p refs Transl. into ENGLISH of 'Emissions de Polluants dans la Stratosphere', ONERA, Paris Report ONERA-P-1976-3, 1976 Original report in FRENCH previously announced as ESA-98182
(ESA-TT-341; ONERA-P-1976-3) Avail: NTIS HC A07/MF A01

A survey is presented of pollutant emissions by turbojet engines. Chemical and physical processes resulting in the formation of polluting species in the combustor are described. Measurement techniques for determining species concentrations in the combustors and jet exhaust are considered. Pollutant formation mechanisms are dealt with from a constructor's point of view. Correlations of nitrogen oxide and carbon monoxide emissions are proposed for most existing engines and, in more detail, for the Olympus turbojet mounted on the Concorde aircraft. Low pollution engines are discussed, and a two module combustor, allowing a reduction of nitrogen oxide production, is described.
ESA

N77-18609# World Meteorological Organization, Geneva (Switzerland).
DETERMINATION OF THE ATMOSPHERIC CONTRIBUTION OF PETROLEUM HYDROCARBONS TO THE OCEANS
W. D. Garrett and V. M. Smagin 1976 37 p refs Sponsored by UN Environment Programme
(WMO-440; SER-6; ISBN-92-63-10440-9) Avail: NTIS HC A03 MF A01; WMO, Geneva

Existing knowledge concerning petroleum hydrocarbons in the marine atmosphere and procedures by which their flux from air to sea may be determined are reviewed. A sampling and analytical program is recommended in order to assess the atmospheric contribution of petroleum. The three phases of the program include air sampling, sea surface sampling, and the collection of precipitation and dry fallout. The possibilities of air-sea interfacial alterations by petroleum films which could influence geophysical processes and climate are discussed. Preliminary estimation was made for the sea-to-air flux of petroleum hydrocarbons.
Author (ESA)

N77-18610# CE Air Preheater, Wellsville, N. Y.
REPORT OF FUEL REQUIREMENTS, CAPITAL COST AND OPERATING EXPENSE FOR CATALYTIC AFTER BURNERS
Sep. 1976 251 p
(Contract EPA-68-02-1473)
(PB-258472/0; EPA-450/3-76-031) Avail: NTIS

HC A12/MF A01 CSCL 13B

Capital and operating costs and fuel consumption of direct flame and catalytic incinerators for volatile organics are provided. Three flow rates (5,000, 15,000 and 30,000 scfm), two inlet temperatures (70 F and 300 F), four concentration levels of organics (0 percent, 5 percent, 15 percent and 25 percent of the lower explosive limit) and four heat recovery options (no recovery, primary heat recovery, primary and secondary heat recovery, and direct reuse of incinerator exhaust) are evaluated. Cost estimates are detailed to enable easy updating or estimation using any set of assumptions. GRA

N77-18611# GARD, Inc., Niles, Ill.
CAPITAL AND OPERATING COSTS OF SELECTED AIR POLLUTION CONTROL SYSTEMS Final Report
M. L. Kinkley and R. B. Neveril May 1976 225 p refs
(Contract EPA-68-02-2072)
(PB-258484/5; EPA-450/3-76-014) Avail: NTIS
HC A12/MF A01 CSCL 13B

Capital, operating, and maintenance costs for air pollution control systems are presented. Capital costs are provided for component equipments, such as ductwork, dampers, heat exchangers, mechanical collectors, fans, motors, stacks, cooling towers, pumps, and dust removal equipment. Five types of control devices are included: (1) high voltage electrostatic precipitators, (2) venturi scrubbers, (3) fabric filters, (4) thermal and catalytic incinerators, (5) adsorbers. Operating and maintenance costs are provided for complete systems. A discussion of the control devices and factors affecting costs is included, along with design parameters for 27 industries. The life cycle cost analysis technique is briefly described, and an example of the cost estimating methodology is given. GRA

N77-18612# Environmental Protection Agency, Chicago, Ill. Air Programs Branch.
TECHNICAL SUPPORT DOCUMENT: SULFUR DIOXIDE CONTROL STRATEGY FOR THE STATE OF OHIO, VOLUME 1 Final Report
Aug. 1976 564 p refs
(PB-257694/0; EPA-905/2-76-002-Vol-1) Avail: NTIS
HC A24/MF A01 CSCL 13B

The methodologies, assumptions and input data used by EPA to promulgate a strategy for the control of sulfur dioxide in the state of Ohio are presented. Explanations of the application of state-of-the-art technology are presented to control strategy development on both a county-by-county and facility-specific basis. The control strategies presented demonstrate attainment of the primary and secondary SO2 ambient air quality standards and continued maintenance of the standards through 1985. The EPA consideration of economics and public and corporate comments and suggestions are included. GRA

N77-18613# Environmental Protection Agency, Chicago, Ill. Air Programs Branch.
TECHNICAL SUPPORT DOCUMENT: SULFUR DIOXIDE CONTROL STRATEGY FOR THE STATE OF OHIO, VOLUME 2 Final Report
Aug. 1976 696 p
(PB-257695/7; EPA-905/2-76-002-Vol-2) Avail: NTIS
HC A99/MF A01 CSCL 13B

The meteorological, ambient air quality, emissions, and other operating statistical data used in the development of sulfur dioxide controls for the State of Ohio are presented. In addition to the computer printouts, the document contains the lists of comments and exhibits received during the public comment period. GRA

N77-18614# ICF, Inc., Washington, D.C.
ISSUES AND IMPACTS ASSOCIATED WITH PROPOSED PREVENTION OF SIGNIFICANT DETERIORATION AND NONATTAINMENT AMENDMENTS TO THE CLEAN AIR ACT Final Report
25 Jul. 1976 99 p refs
(Contract FEA-CO-05-50313-00)
(PB-257461/4; FEA/G-76/313) Avail: NTIS
HC A05/MF A01 CSCL 13B

The report is structured in five chapters. The first chapter is an executive summary. The second chapter presents an analysis of the effects of proposed amendments on key energy variables (e.g., coal production). This analysis employed FEA's Project Independence Evaluation System. The third chapter presents an analysis of the effects of the proposed amendments on non-attainment areas (i.e., areas where violations of ambient air quality standards occur). The fifth presents the findings (mostly preliminary) of analyses of a series of other issues. GRA

N77-18615# National Bureau of Standards, Washington, D.C.
PROGRAM AND ABSTRACTS. SYMPOSIUM ON NON-BIOLOGICAL TRANSPORT AND TRANSFORMATION OF POLLUTANTS ON LAND AND WATER: PROCESSES AND CRITICAL DATA REQUIRED FOR PREDICTIVE DESCRIPTION
May 1976 181 p refs Symp. held at Gaithersburg, Md., 11-13 May 1976 Sponsored in part by EPA, NSF, and ERDA
(PB-257347/5; NBSIR-76-1130) Avail: NTIS
HC A09/MF A01 CSCL 13B

Program, abstracts and extended abstracts of 21 papers presented at a symposium on nonbiological transport and transformation of pollutants on land and in water are documented. Most of the extended abstracts are detailed and contain figures and references to pertinent literature on the subject matter discussed at the symposium. The subject matter reviewed deals with the physical and chemical behavior of pollutants, including pollutant photochemistry, adsorptive behavior of pollutants, hydrolysis, rates of pollutants, and mathematical models for documenting pollutant behavior in soils and water. GRA

N77-18616# Monsanto Research Corp., Dayton, Ohio.
AIR, WATER, AND SOLID RESIDUE PRIORITIZATION MODELS FOR CONVENTIONAL COMBUSTION SOURCES Final Task Report, Jul. 1975 - Apr. 1976
E. C. Eimutis, C. M. Moscowitz, J. L. Delaney, R. P. Quill, and D. L. Zanders Jul. 1976 57 p refs
(Contract EPA-68-02-1404)
(PB-257103/2; MRC-DA-546; EPA-600/2-76-176) Avail: NTIS HC A04/MF A01 CSCL 13B

The water model, similiar to an air prioritization model developed in an earlier study, is based on mass of emission, hazard potential of the emission, ambient water loading, and pollution density in the emission region. Solid emissions were divided into air and water emission components and these contributions were incorporated into air and water prioritization models. The report gives the relative ranking resulting from the application of the models to 56 conventional stationary combustion sources. GRA

N77-18617# Environmental Protection Agency, Washington, D.C. Office of Toxic Substances.
ENVIRONMENTAL HAZARD ASSESSMENT REPORT. MAJOR ONE- AND TWO-CARBON SATURATED FLUOROCARBONS. REVIEW OF DATA Final Report
Frank J. Letkiewicz Aug. 1976 170 p refs
(PB-257371/5; EPA-560/8-76-003) Avail: NTIS
HC A08/MF A01 CSCL 13B

Information on the commercially important one- and two-carbon saturated fluorocarbons pertinent to an assessment of the potential environmental hazard posed by these compounds is reviewed. Aspects discussed are production, uses, environmental effects and biological effects. Major topics are the potential stratospheric ozone depletion effect from continued emissive uses of certain fluorocarbons and the cardiovascular effects resulting from inhalation of these compounds. GRA

N77-18618# Metropolitan Transportation Commission, Berkeley, Calif.
THE EFFECT OF GROWTH AND TRANSPORTATION ALTERNATIVES ON BAY AREA AIR QUALITY: AN APPLICATION OF THE DIFKIN SIMULATION MODEL
V. Petrites, W. Hoffman, F. L. Ludwig, and S. Morse Jul. 1976 105 p refs
(PB-258208/8) Avail: NTIS HC A06/MF A01 CSCL 13B

Air quality forecasts were done for 1977, 1980 and three 1990 alternatives based upon the meteorological conditions of a summer day in 1970. The forecast shows a large improvement in air quality by 1980 and an additional small improvement by 1990; however, the standards were not met. For the prototype day meteorological conditions, the emissions in the early part of

the trajectories were critical determinants of the oxidant level at the end of the trajectory. Changing from a weekday to a Saturday diurnal traffic cycle, with the daily total held constant seemed to have little effect on air quality. GRA

N77-18619# Environmental Protection Agency, Research Triangle Park, N.C. Monitoring and Data Analysis Div.
AIR QUALITY DATA: 1974 ANNUAL STATISTICS Final Report, Jan. - Dec. 1974
Aug. 1976 184 p refs
(PB-258494/4; EPA-450/2-76-011) Avail: NTIS HC A09/MF A01 CSCL 13B

A statistical summary report is presented on ambient air quality, submitted to EPA from air monitoring operations of state, local and Federal networks in accordance with requirements of the Clean Air Act and EPA Regulations for State Implementation Plans (SIP's). These data represent all ambient air quality data sampled for pollutants that currently have National Ambient Air Quality Standards. GRA

N77-18620# Environmental Protection Agency, Ann Arbor, Mich. Emission Control Technology Div.
SHORT TEST CORRELATION TESTING OF 147 IN-USE 1974 MODEL YEAR LIGHT DUTY VEHICLES Final Report, Oct. 1974 - Apr. 1975
Jack Bohl Jul. 1976 187 p
(PB-258679/0; EPA-460/2-76-001) Avail: NTIS HC A09/MF A01 CSCL 03F

Implementation of Section 207(b) of the Clean Air Act, the warranty provision, is contingent upon the identification of a short test that yields emission results that are 'reasonably capable of being correlated with' emission results obtained by the Federal Test Procedure (FTP). Between October 1974 and April 1975, the Environmental Protection Agency tested 147 in use 1974 model year vehicles to gather data to be used for the evaluation of the degree of correlation that exists between emissions as measured by the FTP and by five short tests. The tests evaluated in this program are: the Clayton key mode, the Federal three mode, a high speed unloaded test, the Federal short cycle, and a composite of the New Jersey and New York short tests. The short tests are described in this report, and test results are presented. GRA

N77-18621# Stanford Research Inst., Menlo Park, Calif.
NIOSH ANALYTICAL METHODS FOR SET P
Sep. 1976 63 p ref
(Contract PHS-CDC-99-74-45)
(PB-258434/0; NIOSH-SCP-P) Avail: NTIS HC A04/MF A01 CSCL 07A

Industrial Hygiene sampling and analytical monitoring methods validated under the joint NIOSH/OSHA Standards Completion Program for Set P are contained herein. Monitoring methods for the following compounds are included: 1,1-Dichloro-1-nitroethane, nitrobenzene, tributyl phosphate, triphenyl phosphate, ethylene glycol dinitrate and/or nitroglycerin, p-nitrochlorobenzene, and triorthoeresyl phosphate. GRA

N77-18622# Stanford Research Inst., Menlo Park, Calif.
NIOSH ANALYTICAL METHODS FOR SET Q
Sep. 1976 40 p refs
(Contract PHS-CDC-99-74-45)
(PB-258435/7; NIOSH-SCP-Q) Avail: NTIS HC A03/MF A01 CSCL 07A

Industrial Hygiene sampling and analytical monitoring methods validated under the joint NIOSH/OSHA Standards Completion Program for Set Q are contained herein. Monitoring methods for the following compounds are included: Hydrazine, n-propylnitrate, tetryl, nitrotoluene, and tetranitromethane. GRA

N77-18623# Stanford Research Inst., Menlo Park, Calif.
NIOSH ANALYTICAL METHODS FOR SET N
Sep. 1976 56 p refs
(Contract PHS-CDC-99-74-45)
(PB-258433/2; NIOSH-SCP-N) Avail: NTIS HC A04/MF A01 CSCL 07A

Industrial hygiene sampling and analytical monitoring methods are contained herein. Monitoring methods for the following compounds are included: arsenic and compounds, beryllium and beryllium compounds, nickel, metal and soluble compounds, tin, inorganic compounds except oxides, barium, soluble compounds, calcium oxide, tellurium, and yttrium. GRA

N77-18624# Westvaco Corp., North Charleston, S.C. Charleston Research Center.
DEVELOPMENT OF THE WESTVACO ACTIVATED CARBON PROCESS FOR SOx RECOVERY AS ELEMENTAL SULFUR. VOLUME 1 Final Report, Jan. 1971 - Jun. 1974
G. Nelson Brown, Carl M. Reed, Albert J. Repik, Robert L. Stallings, and Samuel L. Torrence May 1976 298 p refs
(Contract EPA-68-02-0003)
(PB-258303/7; EPA-600/2-76-135-a-Vol-1) Avail: NTIS HC A13/MF A01 CSCL 07A

Granular carbon was recycled continuously more than 20 times between contact with flue gas from an oil-fired boiler and carbon regeneration to recover sulfur. During the 315-hour run, carbon performance remained high with essentially no chemical and low mechanical losses. Over 90 percent of the 2000 ppm SOx was removed from the flue gas as sulfuric acid by catalytic oxidation and subsequent hydrolysis within the carbon granule. In the two-step regeneration: the acid was converted to elemental sulfur at 300F with internally produced H2S, and an external source of hydrogen at 1000F was used to thermally strip the by-product sulfur from the carbon and produce the required H2S by reaction with the remaining sulfur on carbon. GRA

N77-18625# Bechtel Corp., San Francisco, Calif.
EPA ALKALI SCRUBBING TEST FACILITY: ADVANCED PROGRAM Progress Report, 2 Jun. 1975 - Feb. 1976
Sep. 1976 379 p refs
(Contract EPA-68-02-1814)
(PB-258783/0; EPA-600/7-76-008; PR-2) Avail: NTIS HC A17/MF A01 CSCL 07A

Clean operation of the mist eliminator system (3-pass, open-vane chevron with intermittent top and bottom wash) was achieved using lime in the venturi/spray tower system, but plugging occurred with a similar system using limestone in the turbulent contact absorber. In tests to improve limestone utilization, M.E. reliability was found to be a strong function of alkali utilization. Limestone utilization was correlated with scrubber inlet pH, hold tank residence time, and hold tank design. GRA

N77-18626# Air Pollution Technology, Inc., San Diego, Calif.
A. P. S. ELECTRO-TUBE EVALUATION Final Report, Jun. 1975 - May 1976
Seymour Calvert, Christian Christensen, and Charles Lake Jul. 1976 49 p refs
(Contract EPA-68-02-1496)
(PB-258824/2; EPA-600/2-76-154-B) Avail: NTIS HC A03/MF A01 CSCL 07A

Results are given of an evaluation of an Air Pollution Systems (APS) Inc. Electro-Tube, a wet electrostatic precipitator. Fine particle collection efficiency as a function of particle size was computed from data taken on the Electro-Tube. It was operated at gas flow rates of 16.9, 18.9, and 22.9 cu mA/min at ambient conditions. Titanium dioxide was generated as the test aerosol having an approximate mass mean diameter of 1.2 micrometers (A) with a geometric standard deviation of 2.2. Test results indicated that the overall collection efficiency was 96.9%, 98.2%, and 99.3% for the high, medium, and low gas flow rates, respectively. GRA

N77-18627# Naval Weapons Center, China Lake, Calif.
APPLIED POLAROGRAPHY FOR ANALYSIS OF ORDNANCE MATERIALS. PART 2: AN INEXPENSIVE SOLID-STATE FIELD POLAROGRAPH WITH DIGITAL AND ANALOG OUTPUT Final Report, FY 1975 - 1976 on phase 1
Walter J. Becktel and Gerald C. Whitnack Sep. 1976 23 p refs
(SF57572301)
(AD-A030038; NWC-TP-586-Pt-2) Avail: NTIS HC A02/MF A01 CSCL 13/2

A new rapid, specific, and unique polarographic method of analysis of 1,2-propyleneglycoldinitrate (PGDN) in effluent water is described. A portable and inexpensive digital polarograph and monitoring system, built at NWC, are presented for the field analysis of PGDN in an effluent water obtained from a Navy

carbon column cleanup process to remove the explosive from Otto Fuel wastewater. Data obtained by the NWC-developed method of analysis and field equipment compare favorably with data obtained by a vapor-phase chromatographic method on the same samples of effluent water. This report describes in detail the digital polarograph, circuitry, and operational characteristics of the complete polarographic monitoring system. Author (GRA)

N77-18628# Army Construction Engineering Research Lab., Champaign, Ill.
AIR POLLUTION SURVEY GUIDELINES FOR ARMY INSTALLATIONS Final Report
Bernard A. Donahue and Gary W. Schanche Jul. 1976 51 p refs
(DA Proj. 4A1-62121-A-896)
(AD-A029633; CERL-TR-N-5) Avail: NTIS HC A04/MF A01 CSCL 13/2

This report on air pollution survey techniques is the second of a series presenting solid waste, air pollutions, and water pollution survey guidelines. It is intended primarily for use by installation planning, operating, and maintenance personnel. The report presents guidelines for developing a comprehensive air pollution management plan and contains information on emission inventory procedures, source categorization, emission calculations, and regulation comparisons. Air pollution dispersion is discussed, along with factors affecting dispersion, such as source characteristics, meteorological factors, and physiological effects. A section about ambient air monitoring discusses the classification of common air pollutants and some general principles of an ambient air-monitoring network, such as instrument selection and optimum instrument siting. GRA

N77-18629# Naval Research Lab., Washington, D.C.
THE YEARLY SUMMARY OF THE NRL AIR QUALITY DATA (1975) Final Report
Aristides Stamulis Aug. 1976 25 p refs
(AD-A029912; NRL-MR-3351) Avail: NTIS HC A02/MF A01 CSCL 13/2

The NRL air monitoring station went operational in January 1975, and a summary of the air quality data collected for the year is included in this report. The parameters monitored at the station include ozone (O3), sulfur dioxide (SO2), nitrogen dioxide (NO2), total hydrocarbons (THC), methane (CH4), carbon monoxide (CO), wind speed, and wind direction. The instruments are coupled to a data acquisition system including a magnetic tape recorder. A month's data is accumulated on a tape and subsequently processed by a computer program. The monthly computer printout includes hourly and daily air quality data for each parameter plus data on non-methane hydrocarbons which is obtained by subtracting CH4 concentrations from corresponding THC concentrations obtained at the same time. A large amount of information has been accumulated of which only a part has been included in this report. The NRL air quality data is also compared to data obtained by other jurisdictions in the Metropolitan area. Author (GRA)

N77-18630# Battelle Columbus Labs., Ohio.
SURVEY OF EQUIPMENT AND TECHNIQUES TO IDENTIFY AND QUANTIFY DISCHARGED HAZARDOUS CHEMICALS Final Report, Aug. 1975 - Apr. 1976
R. E. Heffelfinger Apr. 1976 68 p refs
(Contract DOT-CG-23223-A)
(AD-A029840; USCG-D-87-76) Avail: NTIS HC A04/MF A01 CSCL 13/2

This report describes the results of a research effort to determine equipment and techniques that may be utilized by the Coast Guard to identify and quantify hazardous chemical discharges via field-oriented equipment incorporated in a mobile unit. The recommended techniques were the following: infrared, gas chromatography, wet chemistry (ion-selective electrodes, color test equipment, separatory equipment, hot plate, glassware), optical emission spectrography, and ultraviolet-visible spectrophotometry. GRA

N77-18631# Acurex Corp., Mountain View, Calif. Aerotherm Div.
CONTROL OF PARTICULATE MATTER FROM OIL BURNERS AND BOILERS Final Report
G. R. Offen, J. P. Kesselring, K. Lee, G. Poe, and K. J. Wolfe Apr. 1976 293 p refs
(Contract EPA-68-02-1318)
(PB-258495/1; EPA-450/3-76-005) Avail: NTIS HC A13/MF A01 CSCL 13B

Possible control measures which Federal, State, or local control agencies might use to reduce particulate emissions in areas where the combustion of oil has a significant impact on air quality are identified. To arrive at viable effective controls, a comprehensive survey was conducted into such techniques as burner design changes, fuel restrictions, additives, mandatory periodic inspection/maintenance programs and particulate collection devices. Emerging technology that may assist boiler and furnace operators to achieve lower particulate emissions was also identified. The experiences gained by agencies with active particulate control programs were evaluated, and their procedures included among the list of possible control measures where appropriate. These findings are summarized along with tabulations of possible control measures according to their stringency and applicability to residential, commercial, industrial, and utility boilers and space heating furnaces. GRA

N77-18632# Battelle Columbus Labs., Ohio.
DEVELOPMENT OF AN ECONOMICS-BASED METHODOLOGY FOR PROJECTING FUTURE POLLUTION PROBLEMS
Gary S. Stacy and James E. Flinn 1976 166 p refs
(Contract EPA-68-01-1837)
(PB-258684/0) Avail: NTIS HC A08/MF A01 CSCL 13B

The research in this project was devoted to developing a methodology having utility for an ultimate purpose of identifying potential future toxic substance pollution problems. An approach was desired that would be systematic, comprehensive, and futuristic. The methodology that resulted is an economics based one that initiates the identification of problems by focusing on the potential for their occurrence in the production, exchange, and consumption of goods and services. GRA

N77-18633# Environmental Protection Agency, Washington, D.C. Office of Toxic Substances.
ANALYSIS OF THE NATIONAL ACADEMY OF SCIENCES' REPORT, DECISION-MAKING FOR REGULATING CHEMICALS IN THE ENVIRONMENT
Jan. 1976 35 p Sponsored by EPA
(PB-258812/7; EPA-560/3-76-001) Avail: NTIS HC A03/MF A01 CSCL 13B

Specific recommendations for improving the decision making process are presented. The Office of Toxic Substances, with input from all interested offices in the agency, prepared the analysis of the 34 recommendations. GRA

N77-18634# Federal Highway Administration, Washington, D.C.
PREFERENTIAL FACILITIES FOR CARPOOLS AND BUSES: SEVEN REPORTS
May 1976 59 p
(PB-258839/0; FHWA-PL-77-005) Avail: NTIS HC A04/MF A01 CSCL 13B

Information on projects to increase the person moving capacity of the highways system by designating facilities for preferential use by high occupancy vehicles is discussed. Different types of priority treatment are presented. The effectiveness of particular projects is analyzed and evaluated. Emphasis is placed on the project design and operational features. GRA

N77-18635# Environmental Monitoring and Support Lab., Research Triangle Park, N.C.
THE EPA PROGRAM FOR THE STANDARDIZATION OF STATIONARY SOURCE EMISSION TEST METHODOLOGY - A REVIEW Final Report
M. Rodney Midgett Aug. 1976 54 p refs
(PB-258847/3; EPA-600/4-76-044) Avail: NTIS HC A04/MF A01 CSCL 14B

These estimates are based on single-run results, and not on the results of three consecutive runs as would be required in conducting compliance testing. A brief discussion is given of the manner in which the precision estimates are derived. Determination of method accuracy is also considered where practical. The design of each test, deficiencies in test designs, and other problems affecting the test results are discussed. An

improved test design that overcomes most of the problems observed in earlier tests is described. A brief discussion of current projects and future plans is given as well as references to the numerous reports on the results of the methods standardization activities. GRA

N77-18636# York Research Corp., Stamford, Conn.
MOLECULAR SIEVE TESTS FOR CONTROL OF SULFURIC ACID PLANT EMISSIONS Final Report, Sep. 1974 - Dec. 1975
Karl R. Boldt and Richard F. Timmons Mar. 1976 292 p
(Contract EPA-68-02-1401)
(PB-258676/6; EPA-600/2-76-047) Avail: NTIS HC A13/MF A01 CSCL 13B

Results of tests of a molecular sieve control system for sulfuric acid plant tail gas are given. The PuraSiv S uses molecular sieve adsorbent material that releases SO2 when heat is applied. The SO2 is recycled for an additional 2-3% production of acid. The report evaluates the PuraSiv S, using data gathered during a 4-week test period. SO2 concentrations were continuously measured and recorded by a DuPont 460/1 Photometric Gas Analyzer at both the inlet and outlet gas streams. Average removal efficiency was 98.0%. Average SO2 emissions during the tests were below 100 ppm. GRA

N77-18637# Energy Resources Co., Inc., Cambridge, Mass.
ASSESSMENT OF THE ENVIRONMENTAL IMPLICATIONS OF PROJECT INDEPENDENCE Final Report
F. Lambie and M. Allen Jul. 1976 272 p
(Contract EPA-68-01-2823)
(PB-259660/9) Avail: NTIS HC A12/MF A01 CSCL 13B

An environmental residuals technique was developed to quantitatively evaluate the environmental implications of Project Independence. Three models are discussed that compare the regional impacts of different scenarios of energy development: a Residual Allocation Model to predict the quantity and distribution of 15 energy-associated pollutant loadings, a Water Use Model to assess the compatibility of water available and water required for projected energy use, and an Air Quality Model to compare the impacts of the scenarios on ambient air quality. The approach is useful for scenario comparison, but is limited in degree of detail and absolute accuracy. It is concluded that the level of control technology achieved is more critical environmentally than the choice of scenarios. GRA

N77-18638# Pittsburgh Univ., Pa. Graduate School of Business.
METHODOLOGY AND MEASUREMENTS OF BENEFITS OF POLLUTION ABATEMENT IN A COMMUNITY
Robert F. Byrne, Michael H. Spiro, Catherine Marshall, and William Capitman (Florida International Univ., Miami) Jun. 1976 98 p refs
(Contract EPA-68-01-1878)
(PB-259452/1) Avail: NTIS HC A05/MF A01 CSCL 13B

The development and successful pilot implementation of a methodology for assessing the benefits of pollution abatement in a community are described. The measure of the benefit is based on the concept of the maximum reduction in income people would voluntarily be willing to accept for a given reduction in pollution. The methodology, combining economic model building and social science survey techniques, was tested with a sample of 99 individuals, all residents of Clairton, Pennsylvania. GRA

N77-18639# President's Air Quality Board, Washington, D. C.
PROCEEDINGS OF PUBLIC MEETING OF THE PRESIDENT'S AIR QUALITY BOARD ON URBAN AIR POLLUTION PROBLEMS
29 Mar. 1976 285 p refs Meeting held at St. Louis, Mo., 29 Mar. 1973 Sponsored by EPA
(PB-259863/9) Avail: NTIS HC A13/MF A01 CSCL 13B

Public hearings on air quality control and air pollution effects in St. Louis are documented. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N77-18640 Institut d'Aeronomie Spatiale de Belgique, Brussels.
RELEASE OF NITRIC OXIDE BETWEEN 80 AND 105 km ALTITUDE: DESCRIPTION OF PAYLOADS AND OBSERVATION MEANS [LACHERS DE MONOXYDE D'AZOTE ENTRE 80 ET 105 km D'ALTITUDE. DESCRIPTION DES CHARGES UTILES ET DES MOYENS D'OBSERVATION]
D. Frimout, C. Lippens, P. C. Simon, E. VanHemelrijck, E. VanRansbeeck, and A. Rehri (CNES) 1976 24 p ref In FRENCH; ENGLISH summary Presented at the Colloq. Intern. Technol. des Experiences Sci. Spatiales, Paris, 26-30 May 1975 Submitted for publication
(Aeronomica-Acta-A-163-1976) Avail: Issuing Activity

An experiment releasing a known quantity of nitric oxide in the lower thermosphere in order to determine the concentration of atomic oxygen by measuring the post luminescence of the reaction NO + O leads to NO2 + photon is described. The payload was composed of four bottles of NO which had to be opened at different altitudes between 80 and 110 km. The bottles were opened by a pyrotechnic system so that quasi spherical clouds were obtained. These releases were programmed in function of time. The observation happened from four ground based stations located on a base line of about 100 km. They were equipped with two types of instruments: to measure the light intensity and to measure the exact positions of the clouds. The instruments were preoriented and received a correction calculated in real time from the radar measurement of the trajectory of the rocket itself. Three payloads were launched with Centaure IIC rockets from the Centre Spatial Guyanais launching range. The results obtained will allow the determination of the vertical distribution of the atomic oxygen after sunset. Author (ESA)

N77-18641*# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
LONG TERM IMPACT OF ANTHROPOGENIC EMISSIONS OF HALOGENATED HYDROCARBONS ON STRATOSPHERIC OZONE LEVEL Final Report
1977 121 p refs Prepared in cooperation with Maryland Univ., College Park
(Grant NsG-1031)
(NASA-CR-149666) Avail: NTIS HC A06/MF A01 CSCL 04A

Reaction kinetics are studied for stratospheric chlorine atoms, OH initiated degradation of carbon-chlorine compounds, the chemical decomposition of stratospheric HCl and ClONO2. A photochemical study is made of the decomposition of O3 over the wavelength range 2935 to 3165 deg A. Author

N77-18642*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
BALLOON STRATOSPHERIC RESEARCH FLIGHTS, NOVEMBER 1974 TO JANUARY 1976
Norman C. Allen Houston NASA Dec. 1976 171 p refs (Contract NAS9-15200)
(NASA-CR-151198; LEC-9904) Avail: NTIS HC A08/MF A01 CSCL 04A

These flights were designed to measure the vertical concentration profile of trace stratospheric species which form major links in the photochemical system of the upper atmosphere. An overview of the specific goals of the program, a statement of program management and support functions, a brief description of the instrumentation flown, pertinent engineering and payload operations data, and a summary of the scientific data obtained for each of the last five flights during this period are presented. Author

N77-18643*# Illinois Univ., Urbana. Aeronomy Lab.
RESEARCH IN AERONOMY Progress Report, 1 Oct. 1975 - 31 Mar. 1976
Belva Edwards, ed. 31 Mar. 1976 131 p refs Sponsored by NASA and NSF

(NASA-CR-149671; PR-76-1) Avail: NTIS HC A07/MF A01 CSCL 04A

This Progress Report for the period October 1, 1975 -- March 31, 1976 contains summaries of work performed by each working group. The summaries have been written as a part of the groups' activities. Author

N77-18644# Kiruna Geophysical Inst. (Sweden).

A COMPARISON OF AURORAL INFRASONIC WAVES IN THE 0.1-0.01 Hz RANGE WITH SIMULTANEOUS SIGNALS ON THE 2 Hz RECEIVER

Hans Westin Jun. 1976 9 p refs Sponsored in part by Swed. Nat. Sci. Res. Council

(Grant NSF GA-41918)

(KGI-76-1) Avail: NTIS HC A02/MF A01

The auroral infrasonic waves in the 0.1 to 0.01 Hz range observed in Kiruna from 1973 to 1975 were compared with the 2 Hz infrasonic recordings in Kiruna. A comparison was possible for 71.5% of the waves. 24% of these had good agreement, and 52% had azimuthal agreement, while the rest had azimuthal agreement within 25 deg. The azimuth and velocity determinations were ambiguous for 57% of the 2 Hz waves, but 81% of the waves had only one solution of the azimuth coming from the north. Signals from the north were common during 54% of the waves. Strong signals from the SW often block the 2 Hz receivers for other waves. Continuous or intermittent signals from the SW were present during nearly 70% of the waves. The amplitudes of these 2 Hz waves are most likely below the background level, which in general is very low during the days of interest. Author (ESA)

N77-18645# World Meteorological Organization, Geneva (Switzerland).

NUMERICAL METHODS USED IN ATMOSPHERIC MODELS, VOLUME 1 Global Atmospheric Research Program

F. Mesinger and A. Arakawa Aug. 1976 75 p refs Prepared jointly with ICSU, Rome

(GARP-Publ-17) Avail: NTIS HC A04/MF A01 WMO, Geneva

Methods used for the solution of hydrodynamic governing equations in numerical models of the atmosphere are discussed. In particular grid point finite difference methods and problems and methods used for time and horizontal space differencing are covered. Specific problems relating to the numerical solution of the advection and gravity wave equations are discussed. ESA

N77-18646# California Univ., Berkeley. Earthquake Engineering Research Center.

A SUBSTRUCTURE METHOD FOR EARTHQUAKE ANALYSIS OF STRUCTURE-SOIL INTERACTION

Jorge A. Gutierrez and Anil K. Chopra Apr. 1976 153 p refs (Grant NSF ATA-74-20554)

(PB-257783/1; EERC-76-9) Avail: NTIS HC A08/MF A01 CSCL 13M

A general substructure method for analysis of response of structures to earthquake ground motion including the effects of structure-soil interaction is presented. Flexibility of the structural base, spatial variations in the free field ground motion, structural embedment and interaction between two or more structures, all these factors are included in the analysis. The soil region may be idealized either as a homogenous halfspace or as an assemblage of finite elements. In the latter case, results are shown to be equivalent with a direct finite element analysis. However, it is shown that the substructure method is more efficient. The structure-soil system is considered as composed of two substructures--the structure and the soil region--and the analysis via the frequency domain is carried out in two stages. The earthquake input is defined as the free field ground motion at the structure-soil interface. The dynamic stiffness (or impedance) matrix for the soil region, determined separately, enters into the governing equations for the structure. GRA

N77-18647# Air Force Geophysics Lab., Hanscom AFB, Mass.

ATS-6 40- AND 360-MHz DIFFERENTIAL PHASE MEASUREMENTS Environmental Research Papers.

Frederick F. Slack 2 Jun. 1976 31 p refs

(AF Proj. 4643)

(AD-A030739; AFGL-TR-76-0119; AFGL-ERP-564) Avail: NTIS HC A03/MF A01 CSCL 09/3

Equipment employing new cross-correlation design concepts for receiving and processing weak rf signals in a noisy environment is described. It is shown how this equipment becomes an integral part of the instrumentation for measuring the differential phase between the ATS-6 satellite 40- and 360-MHz coherent cw signals that have been propagated through the ionosphere. The relationship between 40-MHz phase and amplitude scintillation was developed using differential phase data from the ATS-6 geostationary satellite. The 40- and 360-MHz coherent signals were propagated through the ionosphere and received on the 150-ft radio telescope at the Sagamore Hill Radio Observatory. The influence that the traveling ionospheric disturbances (TID) have on the phase of the 40-MHz signal receives special emphasis, and it is shown how the presence of TID aids in the analysis. GRA

N77-18648*# Texas Instruments, Inc., Dallas. Equipment Group.

VELA NETWORK EVALUATION AND AUTOMATIC PROCESSING RESEARCH Quarterly Report, 10 Apr. - 10 Jul. 1976

Lawrence S. Turnbull, Jr. 10 Jul. 1976 17 p

(Contract F08606-76-C-0011; ARPA Order 2551)

(AD-A030165; TI-ALEX(01)-QR-76-04; QR-4) Avail: NTIS HC A02/MF A01 CSCL 08/11

This fourth quarterly report summarizes progress under the VELA Network and Automatic Processing Research Program. Work in the following areas is summarized: array and network evaluation, signal detection methods, signal estimation techniques, and discrimination. GRA

N77-18649# State Univ. of New York, Stony Brook. Dept. of Earth and Space Sciences.

MECHANICAL PROPERTIES OF GRANULAR SILICATES AT DEPTH Final Report, 1 Jul. 1975 - 30 Jun. 1976

Neville Carter 1 Aug. 1976 29 p refs

(Contract F19628-76-C-0048; AF Proj. 8607)

(AD-A029441; AFGL-TR-76-0183) Avail: NTIS HC A03/MF A01 CSCL 08/7

Granular silicates comprise a substantial part of the earth's crust, and yet there have been few attempts at determining their physical properties and flow processes experimentally. The goal of the research was to attempt to obtain these data, for a variety of granular silicates, at elevated temperatures and pressures, both in the presence and absence of pore fluids. The primary equipment to be used was Griggs-Heard 10 kb argon triaxial deformation apparatus because of the sensitivity required. Recrystallized grain sizes in wet quartzite deformed experimentally in the steady state show a marked inverse dependence on stress and are virtually independent of temperature and strain rate. This dependence, which is similar to that observed for dynamically recrystallized metals and olivine, is given by $D = 6.5 \sigma^{-1.4}$ where D is the new grain size in microns and sigma is the differential stress in kilobars. If these preliminary observations are substantiated, stress magnitudes during creep of quartzite in the crust may be determined directly for the first time. GRA

N77-18650# Ballistic Research Labs., Aberdeen Proving Ground, Md.

AIRCHEM: A COMPUTATIONAL TECHNIQUE FOR MODELING THE CHEMISTRY OF THE ATMOSPHERE

Edna L. Lortie, Mark D. Kregel, and Franklin E. Niles Aug. 1976 299 p refs

(DA Proj. 1T1-61102-B-53A; DNA Proj. NWED-QAXHD010)

(AD-A030157; BRL-1913) Avail: NTIS HC A13/MF A01 CSCL 04/1

Deionization processes thought to describe the real-time concentrations of ion and neutral constituents in the ionized stratosphere and mesosphere can be modeled numerically by a number of techniques of varying complexity and efficiency. One very efficient technique for complex cases is the AIRCHEM computer program. The AIRCHEM program utilizes the K-method for solving the ordinary differential equations which arise from the mathematical description of atmospheric deionization processes, many of which are characterized by exceedingly short time constants. This report serves to give the mathematical description of atmospheric deionization as modeled by AIRCHEM

and also serves as a user's manual for those interested in using the program. Included is a complete FORTRAN listing of the AIRCHEM program along with sample input and the corresponding output from a sample run. Author (GRA)

N77-18651# Air Force Geophysics Lab., Hanscom AFB, Mass.
STUDIES OF LOW-ENERGY PLASMA MOTION: RESULTS AND A NEW TECHNIQUE Environmental Research Papers
Peter J. L. Wildman 25 Jun. 1976 23 p refs
(AF Proj. 8617)
(AD-A030333; AFGL-TR-76-0168; AFGL-ERP-571) Avail: NTIS HC A02/MF A01 CSCL 04/1

This report is divided into two sections. The first describes the results of a comprehensive study of the mid-latitude trough. This is a depletion of ionospheric plasma that can occur at all local times and is due to the convection and diffusion of low energy plasma in latitude regions where magnetic field lines extend many earth radii in the anti-sunward direction. The morphology of the trough is described in terms of local time variations of its width, depth, gradients, and location. The second section of the report describes the design and operation of a new ion sensor experiment package that makes direct measurements of the bulk motion of the low energy plasma. The experiment is an array of planar ion sensors to determine the magnitude and direction of the ion bulk motion as seen from a spin-stabilized satellite. GRA

N77-18652# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
AN EVALUATION OF SEVERAL MODELS FOR DESCRIBING THE ATMOSPHERIC WATER-VAPOR PROFILE ABOVE THE -40 C TEMPERATURE LEVEL Final Report
Laurence D. Mendenhall Aug. 1976 20 p refs
(AD-A030156; USAFETAC-8035) Avail: NTIS HC A02/MF A01 CSCL 04/1

Conventional meteorological radiosonde humidity data are not reliable above the -40 C temperature level. An investigation of several models of the water-vapor profile above the -40 C level using frost-point data obtained from the Naval Research Laboratory (NRL) revealed that a simple model worked as well as more complex models to calculate the precipitable water. This model incorporates an estimate of the frost-point temperature, which is calculated with a regression equation, a hygropause fixed at 1 km above the tropopause, and an interpolated value of the mixing ratio. Author (GRA)

N77-18653# Analysis and Computer Systems, Inc., Burlington, Mass.
ANALYTICAL AND PROCESSING TECHNIQUES FOR ROCKET AND SEARCHLIGHT PROBE DATA WHICH BEAR UPON NUMBER DENSITY COMPUTATION, AEROSOL SCATTERING, AND OPTICAL EMISSIONS Interim Report
Allan G. Cronin, Harold L. Dolan, III, and Peter W. Lindstrom Apr. 1976 67 p
(Contract F19628-74-C-0169)
(AD-A029439; Scientific-2; AFGL-TR-76-0092) Avail: NTIS HC A04/MF A01 CSCL 04/1

This report describes a number of numerical and processing procedures that were developed to aid Air Force Geophysics Laboratory (AFGL) researchers in the analysis and interpretation of experimental data. The research areas for which these techniques were developed include: The determination of number densities of upper atmospheric constituents, the study of atmospheric aerosol properties, and the study of atmospheric optical emissions. GRA

N77-18654# Lamont-Doherty Geological Observatory, Palisades, N. Y.
PLATE TECTONICS AND THE DISCRIMINATION OF UNDERGROUND EXPLOSIONS FROM EARTHQUAKE Semiannual Report, 1 Oct. 1975 - 30 Mar. 1976
Andrew J. Murphy 19 Aug. 1976 9 p refs
(Contract F19628-76-C-0075; ARPA Order 1975; AF Proj. 1795)
(AD-A030303; AFGL-TR-76-0172; SAR-1) Avail: NTIS HC A02/MF A01 CSCL 08/7

During the six month period covered by this report, research was carried out in the following three areas of interest to this contract: (1) a study of the velocity structure under the Tibetan Plateau using at least ten Tibetan earthquakes recorded by nearby WWSSN stations; (2) a study of causes of variations in Ms-M sub b relation for a Central Asian earthquake sequence to determine what factors other than source depth and focal mechanism control the surface wave magnitude for small events; and (3) a study of the distribution of great shallow earthquakes. GRA

N77-18655# Northwestern Univ., Evanston, Ill. Technological Inst.
REMOTE MEASUREMENT OF WATER VAPOR CONCENTRATION IN THE ATMOSPHERE BY FLUORESCENCE ADSORPTION AND BACKSCATTERING FROM A TUNABLE LASER RADAR Final Report, 1 Mar. 1974 - 30 Jun. 1975
Arthur J. Freeman, Marvin B. Lewis, and Gilbert D. Stein Sep. 1976 21 p refs
(Contract N00014-67-A-0356-0032; NR Proj. 082-320)
(AD-A030404; Rept-5341-421) Avail: NTIS HC A02/MF A01 CSCL 04/1

A tunable laser radar system was designed to detect the water vapor content in the atmosphere by remote sensing. The basic physical process involved is the molecular resonance adsorption of water molecules. The method proposed is the differential adsorption method which compares the backscattering signal for a wavelength off a water adsorption line to the signal for a wavelength on a water adsorption line. Author (GRA)

N77-18656# Naval Research Lab., Washington, D.C.
OBSERVATIONS OF ELECTRON TEMPERATURE GRADIENTS IN MID-LATITUDE E SUB S-LAYERS
Edward P. Szuszczewicz and Julian C. Holmes Aug. 1976 38 p refs
(NRL Proj. A02-11)
(AD-A030345; NRL-MR-3345) Avail: NTIS HC A03/MF A01 CSCL 04/1

Using a newly-developed pulsed plasma probe, direct measurements of electron temperature were performed within mid-latitude sporadic-E layers above White Sands, New Mexico. The probe's capability for unfolding density variations from its current-voltage characteristic made the temperature measurements possible within the steep density gradients characteristic of E sub s layers. The major feature of the observations was the presence of an electron temperature gradient across the layers: the bottom-sides of the layers were isothermal at T sub e = 340 K while the topside of each layer showed T sub e increasing to 500 K over a vertical extent of 400 meters. These results demonstrate the principal element in the prediction of electron temperature variations in mid-latitude sporadic-E: that there is a minimum in the electron temperature within a layer with the temperature increasing toward the edges of the layer where electron densities are low. It is shown that layers formed primarily by long lived ions have this minimum at the position of the maximum electron concentration. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N77-18657*# Tennessee Univ. Space Inst., Tullahoma.
A FIELD STUDY OF WIND OVER A SIMULATED BLOCK BUILDING
Walter Frost and Alireza M. Shahabi Washington NASA Mar. 1977 131 p refs
(Contracts NAS8-29584; NSF GK-42942)
(NASA-CR-2804; M-201) Avail: NTIS HC A07/MF A01 CSCL 04B

A full-scale field study of the wind over a simulated two-dimensional building is reported. The study develops an experiment to investigate the structure and magnitude of the wind fields. A description of the experimental arrangement, the type and expected accuracy of the data, and the range of the data are given. The data are expected to provide a fundamental understanding of mean wind and turbulence structure of the

wind field around the bluff body. Preliminary analysis of the data demonstrates the reliability and completeness of the data in this regard. Author

N77-18658*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LASER DOPPLER DUST DEVIL MEASUREMENTS
James W. Bilbro, Harold B. Jeffreys, John W. Kaufman, and Edwin A. Weaver Washington Feb. 1977 89 p refs
(NASA-TN-D-8429; M-211) Avail: NTIS HC A05/MF A01 CSCL 04B

A scanning laser doppler velocimeter (SLDV) system was used to detect, track, and measure the velocity flow field of naturally occurring tornado-like flows (dust devils) in the atmosphere. A general description of the dust devil phenomenon is given along with a description of the test program, measurement system, and data processing techniques used to collect information on the dust devil flow field. The general meteorological conditions occurring during the test program are also described, and the information collected on two selected dust devils are discussed in detail to show the type of information which can be obtained with a SLDV system. The results from these measurements agree well with those of other investigators and illustrate the potential for the SLDV in future endeavors. Author

N77-18659*# Texas A&M Univ., College Station. Center for Applied Geosciences.
GRADIENTS OF METEOROLOGICAL PARAMETERS IN CONVECTIVE AND NONCONVECTIVE AREAS
Milton S. McCown and James R. Scoggins Washington NASA Mar. 1977 93 p refs
(Contract NAS8-31773)
(NASA-CR-2818; M-214) Avail: NTIS HC A05/MF A01 CSCL 04B

Horizontal gradients of geopotential height, temperature, and wind speed were computed at the 850-, 700-, 500-, and 200-mb levels. Mixing ratio gradients also were computed, but only for the 850-, 700-, and 500-mb levels. Rawinsonde data was provided at 3- to 6-h intervals. Cumulative frequency distributions and statistical parameters showed that the variability and magnitude of the gradients decreased as the gradients were computed over progressively longer distances. Most frequency distributions were positively skewed, and the standard deviations of the gradient distributions were roughly half as large as the means. An examination of the differences of gradients observed in convective and nonconvective areas was made after convective areas were determined objectively using Manually Digitized Radar data. The gradients of height, wind speed, and mixing ratio at 850 mb were larger in convective than nonconvective areas. No general relationship held for the meteorological variables at other levels. Intensive examination of the gradients observed near squall lines revealed typical gradient patterns and trends in the magnitudes of the gradients associated with convective systems. Author

N77-18660*# Texas A&M Univ., College Station.
VORTICITY IMBALANCE AND STABILITY IN RELATION TO CONVECTION Final Report
William L. Read and James R. Scoggins Huntsville, Ala. NASA Mar. 1977 120 p refs
(Contract NAS8-31773)
(NASA-CR-2819; M-215) Avail: NTIS HC A06/MF A01 CSCL 04B

A complete synoptic-scale vorticity budget was related to convection storm development in the eastern two-thirds of the United States. The 3-h sounding interval permitted a study of time changes of the vorticity budget in areas of convective storms. Results of analyses revealed significant changes in values of terms in the vorticity equation at different stages of squall line development. Average budgets for all areas of convection indicate systematic imbalance in the terms in the vorticity equation. This imbalance resulted primarily from sub-grid scale processes. Potential instability in the lower troposphere was analyzed in relation to the development of convective activity. Instability was related to areas of convection; however, instability alone was inadequate for forecast purposes. Combinations of stability and terms in the vorticity equation in the form of indices succeeded in depicting areas of convection better than any one item separately. Author

N77-18661*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AN INVESTIGATION OF THE TEMPORAL CHARACTER OF MESOSCALE PERTURBATIONS IN THE TROPOSPHERE AND STRATOSPHERE
William W. Vaughan Washington Mar. 1977 89 p refs
(NASA-TN-D-8445; M-217) Avail: NTIS HC A05/MF A01 CSCL 04B

The effectiveness of mesoscale models in explaining perturbations observed in vertical detailed wind profile measurements in the troposphere and lower stratosphere is assessed. The structure and persistence of the data were analyzed and interpreted in terms of several physical models with the goal of establishing explanations for the observed persistent features of the mesoscale flow patterns. The experimental data used in the investigation were obtained by a unique detailed wind profile measurement system. This system is capable of providing resolution of 50 to 100 m wavelengths for the altitude region from approximately 200 m to 18 km. The system consists of a high-resolution tracking radar and special super-pressure balloon configuration known as a Jimsphere. Author

N77-18662*# Institute on Man and Science, Rensselaerville, N. Y.
POSITION PAPER ON THE POTENTIAL OF INADVERTENT WEATHER MODIFICATION OF THE FLORIDA PENINSULA RESULTING FROM THE STABILIZED GROUND CLOUD Final Report, Mar. - Aug. 1976
Eugene Bollay (Bollay Assoc., Santa Barbara, Calif.), Lance Bosart (Albany Univ., N.Y.), Earl Droessler (N.C. State Univ., Raleigh), James Jiusto (Albany Univ., N.Y.), G. Garland Lala (Albany Univ., N.Y.), Volker Mohnen (Albany Univ., N.Y.), Vincent Schaefer (Albany Univ., N.Y.), and Patrick Squires (Desert Research Inst.) Aug. 1976 209 p refs
(Contract NAS9-14940)
(NASA-CR-151199; Rept-1) Avail: NTIS HC A10/MF A01 CSCL 04B

Based on the climatology of the Florida Peninsula, we assessed the risk for weather modification. Certain weather situations warrant launch rescheduling because of the risk of possible impact on hurricanes, hail formation and lightning activity, strong wind developments, and intensification of high rainfall rates. The cumulative effects of 40 launches per year on weather modification were found to be insignificant. Author

N77-18663*# M&S Computing, Inc., Huntsville, Ala.
WIND INFORMATION DISPLAY SYSTEM USER'S MANUAL Final Report
Jim Roe and George Smith 27 Jan. 1977 63 p
(Contract NAS8-32024)
(NASA-CR-150199; Rept-77-0007) Avail: NTIS HC A04/MF A01 CSCL 04B

The Wind Information Display System (WINDS) provides flexible control through system-user interaction for collecting wind shear data, processing this data in real time, displaying the processed data, storing raw data on magnetic tapes, and post-processing raw data. The data are received from two asynchronous laser Doppler velocimeters (LDV's) and include position, velocity and intensity information. The raw data is written onto magnetic tape for permanent storage and is also processed in real time to depict wind velocities in a given spacial region. Author

N77-18664# World Meteorological Organization, Geneva (Switzerland).
THE QUANTITATIVE EVALUATION OF THE RISK OF DISASTER FROM TROPICAL CYCLONES
1976 148 p refs
(WMO-455; SER-8; ISBN-92-63-10455-7) Avail: NTIS HC A07/MF A01; WMO, Geneva

Techniques which can be used by national meteorological and hydrological services to assess in quantitative terms the risk of damage from tropical cyclones to human settlements and to economic development are described. The report is divided into two components - meteorological aspects covering fundamental characteristics of tropical cyclones (frequency of occurrence, intensity, direction, speed), wind and rainfall distribution and storm surges; and hydrological aspects covering tropical cyclone

rainfall depth, duration and frequency distribution, and the use of hydrological models for estimating risk of flood river discharges. For individual titles, see N77-18665 through N77-18666.

N77-18665# World Meteorological Organization, Geneva (Switzerland).
METEOROLOGICAL ASPECTS OF TROPICAL CYCLONES
In its The Quant. Evaluation of the Risk of Disaster from Trop. Cyclones 1976 p 1-53 refs (For primary document see N77-18664 09-47)
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In assessing the risk of damage from tropical cyclones the meteorological aspects of the storms are discussed. The fundamental characteristics of cyclones - frequency of occurrence, intensity, direction and speed of movement; wind and rainfall distribution; storm surges - frequency, height distribution, and relationship to tropical cyclone parameters are also discussed. esa

N77-18666# World Meteorological Organization, Geneva (Switzerland).
HYDROLOGICAL ASPECTS OF TROPICAL CYCLONES
In its The Quant. Evaluation of the Risk of Disaster from Trop. Cyclones 1976 p 56-143 refs (For primary document see N77-18664 09-47)
Copyright. Avail: NTIS HC A07/MF A01; WMO, Geneva

In assessing the risk of damage from tropical cyclones the hydrometeorological aspects of tropical cyclone rainfall - depth, duration, frequency relationships - are discussed. The use of hydrological models for estimating risks of flood river discharges resulting from rainfall of given characteristics, is also discussed. ESA

N77-18667# Wyoming Univ., Laramie.
EVALUATION OF WIND-ENERGY SITES FROM AEOLIAN GEOMORPHOLOGIC FEATURES MAPPED FROM LANDSAT IMAGERY. FIRST RESULTS
K. Kolm, R. Marrs, J. Marwitz, and J. Fletcher 1 Dec. 1975 39 p refs Sponsored in part by ERDA
(Grant NSF AER-75-00598)
(ERDA/NSF/00598-75/T1) Avail: NTIS HC A03/MF A01

Aeolian geomorphologic features, interpreted from satellite imagery are related to areas of high-wind-energy potential. Preliminary results, gathered during spring and summer months, were evaluated statistically to determine the critical interrelationships for the Killpecker test area. These tests indicate that the morphology of individual dunes is not a unique indicator of wind velocity or persistance, but the morphology of the dune field is an indicator that can be used to predict areas of high wind-energy potential. These results will be used as a guide to prediction of other areas of high wind-energy potential. Field measurements will then be used to test these predictions. Similar evaluations are being made in the Big Hollow Area where aeolian erosional phenomena dominate the geomorphologic development. ERA

N77-18668# Colorado State Univ., Fort Collins.
GENERAL CIRCULATION OF THE ATMOSPHERE AND WEATHER IN THE MEDITERRANEAN
Elmar R. Reiter 1976 30 p refs Presented at the Intern. School of Atmospheric Sci., Erice, Trapani, Sicily, Italy, 16-31 May 1976 Sponsored by ERDA
(COO-1340-50; Conf-760553-1) Avail: NTIS HC A03/MF A01

The occurrence of mistral winds in the Mediterranean shows a correlation with blocking activity over the eastern Atlantic. Apparently for this reason, periods with a midwinter dip in the zonal available potential energy of the Northern Hemisphere are favored by mistral occurrence. There also is a tendency for a 22- to 26-day cycle to appear in pressure gradients at the 500- and 100-mb surfaces along the southern coast of France. Such pressure gradients, if they exceed a certain magnitude, are indicative of mistral episodes. ERA

N77-18669# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
PROBLEMS IN GENERAL CIRCULATION RESEARCH AND LONG-RANGE WEATHER FORECASTING
Elmar R. Reiter 1976 37 p refs Presented at Intern. School of Atmospheric Sci., Erice, Trapani, Sicily, Italy, 16 May 1976 (Contract E(11-1)-1340)
(COO-1340-49; Conf-760553-2) Avail: NTIS HC A03/MF A01

The vacillatory behavior of the atmospheric energy cycle in the Northern Hemisphere is discussed in some detail. A mid-winter dip in zonal available potential energy (AZ) of variable duration and date of occurance has been tied to the development of blocking anticyclones in the Pacific and Atlantic. A 22 to 24-day vacillation in the atmospheric energy modes has been identified. ERA

N77-18670# Oak Ridge National Lab., Tenn.
USE OF A POWERED GLIDER EQUIPPED WITH INSTRUMENTS FOR STRUCTURAL STUDY OF MAN-MADE THERMAL CONVECTION
H. Fortak 1975 57 p refs Transl. into ENGLISH of report from Deutsche Forschungsgemeinschaft, Apr. 1974 - May 1975 Sponsored by ERDA
(ORNL-TR-4101) Avail: NTIS HC A04/MF A01

The use of an aircraft for making meteorological measurements in order to solve a special problem of the man-made burden in the atmosphere is described. From the results of many transverse flights over cross sectional surfaces of the streams, it was shown that in proximity to the cooling tower (up to a distance of 2 or 3 km) the currents behave very similarly to a turbulent free jet. The structure of the stream has the peculiarity that, in its upper part, sudden changes in moisture predominate, while at the lower levels the abrupt temperature changes appear to have greater significance. The stream is not limited to the visible part but, owing to the measured abrupt changes in moisture and temperature, is also detectable below this. ERA

N77-18671# World Meteorological Organization, Geneva (Switzerland).
INTERPRETATION OF BROAD-SCALE NWP PRODUCTS FOR LOCAL FORECASTING PURPOSES
Oct. 1976 262 p refs Proc. of WMO Symp. held at Warsaw, 11-16 Oct. 1976
(WMO-450; ISBN-92-63-10450-6) Avail: NTIS HC A13/MF A01; WMO, Geneva

Papers are presented in the following areas: meso-scale dynamic models; statistical interpretation of numerical predictions; and manual modification of numerical products man machine mix. For individual titles, see N77-18672 through N77-18706.

N77-18672# Edinburgh Univ. (Scotland). Dept. of Meteorology.
ON THE CHOICE OF AN OBJECTIVE ANALYSIS SCHEME SUITABLE FOR MESO-SCALE NUMERICAL MODELS
Charles N. Duncan *In* WMO Interpretation of Broad-Scale NWP Prod. for Local Forecasting Purposes Oct. 1976 p 1-8 refs (For primary document see N77-18671 09-47)
Copyright. Avail: NTIS HC A13/MF A01; WMO, Geneva

It is shown that the root-mean-square difference between observation and analyses is not a satisfactory measure of the usefulness of an analysis. The independent vector method of assessment which is described is considered suitable because the relationship of any one observation to other observations is taken into account. Two case studies are described using the independent vector technique based on random vectors. ESA

N77-18673# Meteorologischer Dienst der DDR, Potsdam (East Germany).
AN APPROXIMATIVE DERIVATION OF LATERAL BOUNDARY CONDITIONS FOR THE DRY BAROCLINIC PRIMITIVE EQUATIONS ON THE BASIS OF A LINEARIZED SYSTEM
H.-J. Herzog and A. Meyer *In* WMO Interpretation of Broad-Scale NWP Prod. for Local Forecasting Purposes Oct. 1976 p 10-14 refs (For primary document see N77-18671 09-47)
Copyright. Avail: NTIS HC A13/MF A01; WMO, Geneva

An approximate derivation of lateral boundary conditions for the dry baroclinic primitive equations on the basis of a linearized system is described. ESA

N77-18674# Technische Universitaet, Hanover (West Germany). Inst. fuer Meteorologie und Klimatologie.

VARIABLY FINE MESH IN SPECTRAL GLOBAL MODELS
Frank Schmidt *In* WMO Interpretation of Broad-Scale NWP Prod. for Local Forecasting Purposes Oct. 1976 p 15-19 ref (For primary document see N77-18671 09-47)
Copyright. Avail: NTIS HC A13/MF A01; WMO, Geneva

The use of global spectral methods for resolution prediction is discussed. The method utilizes transformed spherical harmonics where the corresponding spherical transformation represents a certain resolution geometry with compressed and dilated areas. ESA

N77-18675# Swedish Meteorological and Hydrological Inst., Norkoeping.
AN UNSTEADY ONE-DIMENSIONAL ATMOSPHERIC BOUNDARY LAYER MODEL
Svante Bodin *In* WMO Interpretation of Broad-Scale NWP Prod. for Local Forecasting Purposes Oct. 1976 p 20-26 refs (For primary document see N77-18671 09-47)
Copyright. Avail: NTIS HC A13/MF A01; WMO, Geneva

A one-dimensional atmospheric boundary layer model aimed at giving guidance for local weather forecasts at Swedish airports is described. The model will be coupled to a synoptic scale numerical prediction model that will supply time varying boundary values to the local models. ESA

N77-18676# Technical Univ. of Warsaw (Poland). Inst. of Environmental Engineering.
PARAMETERIZATION OF DYNAMICAL STRUCTURE OF BOUNDARY LAYER IN URBAN AREAS
Zbigniew Sorbjan *In* WMO Interpretation of Broad-Scale NWP Prod. for Local Forecasting Purposes Oct. 1976 p 27-31 refs (For primary document see N77-18671 09-47)
Copyright. Avail: NTIS HC A13/MF A01; WMO, Geneva

Since it is impossible to adapt the forecasts of rural meteorological conditions in low atmosphere to urban areas, a simple model of the urban boundary layer which can be nested in a numerical model has been developed. The model uses steady state, horizontally homogeneous, barotropic boundary layer equations, modified for urban conditions. ESA

N77-18677# Servizio Meteorologico dell'Aeronautica Militaire (Italy).
A FINE MESH MODEL FOR THE STUDY AND PREDICTION OF HIGH TIDES IN THE ADRIATIC SEA
Carlo Finizio, Sabino Palmieri, and Roberto Cozzi *In* WMO Interpretation of Broad-Scale NWP Prod. for Local Forecasting Purposes Oct. 1976 p 32-37 refs (For primary document see N77-18671 09-47)
Copyright. Avail: NTIS HC A13/MF A01; WMO, Geneva

A numerical forecasting model of the surface winds on the Adriatic Sea is described wherein the wind is determined by equations of motion coupled with the continuity equation. ESA

N77-18678# Bull General Electric, Paris (France). Inst. for Hydrology and Meteorology.
HYDRODYNAMIC MESO-METEOROLOGICAL FORECAST WITH ACCOUNT TAKEN OF THE OROGRAPHY
V. I. Zahariev *In* WMO Interpretation of Broad-Scale NWP Prod. for Local Forecasting Purposes Oct. 1976 p 38-44 refs (For primary document see N77-18671 09-47)
Copyright. Avail: NTIS HC A13/MF A01; WMO, Geneva

A numerical method for a mesoscale weather forecast which takes into account the orographic factors is described. The atmosphere is considered as an ideal compressive fluid changing with the adiabatic processes, and the problem is solved for a dry two-layer model - at the earth's surface and at 500 mb. An experiment with the model is described. ESA

N77-18679# Swiss Inst. of Meteorology, Zurich.
DYNAMICAL-STATISTICAL METHODS OF MESO-SCALE PRECIPITATION FORECASTING OVER MOUNTAINOUS TERRAIN
W. Kuhn and J. Quiby *In* WMO Interpretation of Broad-Scale NWP Prod. for Local Forecasting Purposes Oct. 1976 p 45-52 refs (For primary document see N77-18671 09-47)
Copyright. Avail: NTIS HC A13/MF A01; WMO, Geneva

The development of a diagnostic model that would permit a regional differentiation of the predicted large-scale meteorological fields in the Swiss Alps is described. Two models were considered for the determination of the vertical wind component and these are discussed together with boundary layer effects and perturbations caused by the Alps. From the different computed vertical velocities the prediction of regional precipitation is inferred. ESA

N77-18680# Chinese Academy of Sciences, Peking. Inst. of Meteorology.
INFERENCE OF THE LOCAL WEATHER FROM THE LARGE-SCALE NUMERICAL WEATHER PREDICTION. A STUDY ON THE LEE-WAVES TO THE EAST OF THE TAIHANG MOUNTAIN
Tu Hsing-yuan and Hsu You-feng *In* WMO Interpretation of Broad-Scale NWP Prod. for Local Forecasting Purposes Oct. 1976 p 53-59 (For primary document see N77-18671 09-47)
Copyright. Avail: NTIS HC A13/MF A01; WMO, Geneva

The weather associated with the lee side of the Taihang Mountain in north China is first discussed followed by a summary of the parameters necessary to calculate lee waves. A dynamic model of lee waves is described, and its use in forecasting this type of weather is illustrated by two examples. ESA

N77-18681# Swedish Meteorological and Hydrological Inst., Norkoeping.
EXPERIENCES FROM OPERATIONAL APPLICATION OF STATISTICAL INTERPRETATION IN WEATHER FORECASTING IN SWEDEN
Olov Loennqvist *In* WMO Interpretation of Broad-Scale NWP Prod. for refs (For primary document see N77-18671 09-47)
Copyright. Avail: NTIS HC A13/MF A01; WMO, Geneva Local Forecasting Purposes Oct. 1976 p 63-69

Automatic interpretation of numerical forecast charts is outlined together with a summary of the presentation of interpretation products. Statistical techniques whereby actual observations and analysis charts are used synchronously with the weather observations are considered. The role of verification in applying statistical techniques is noted, and Swedish operational experience in statistical weather forecasting is discussed. ESA

N77-18682# Direction de la Meteorologie Nationale, Paris (France).
REGRESSION AND DISCRIMINANT LOCAL FORECASTING SCHEMES USING DATA FROM NUMERICAL WEATHER PREDICTION
J. Coiffier, G. Der-Megreditchian, H. Kerrache (Hydrometeorol. Training and Res. Inst.), and J. Lepas (Hydrometeorol. Training and Res. Inst.) *In* WMO Interpretation of Broad-Scale NWP Prod. for Local Forecasting Purposes Oct. 1976 p 70-77 refs (For primary document see N77-18671 09-47)
Copyright. Avail: NTIS HC A13/MF A01; WMO, Geneva

An application of multivariate statistical analyses to short-range local forecasting at Oran, Algeria, is described. Two kinds of meteorological parameters - continuous quantitative variables and discrete qualitative variables - are considered as well as synchronous and asynchronous forecasting strategies. In order to determine the coefficients of the regression and discrimination forecasting schemes a learning sample of 7 years, a test sample of 1 year, and an operational forecast of 3 months were used. ESA

N77-18683# Norwegian Meteorological Inst., Blindern.
A PROGNOSTIC MODEL BASED ON FREQUENCY SPECTRUM OF ELEMENTS IN DEFINED SYNOPTIC CATEGORIES
Jan-Ole Flaeten *In* WMO Interpretation of Broad-Scale NWP Prod. for Local Forecasting Purposes Oct. 1976 p 78-84 refs (For primary document see N77-18671 09-47)
Copyright. Avail: NTIS HC A13/MF A01; WMO, Geneva

An objective aid in deducing from numerical upper air prognosis quantitative as well as qualitative occurrence of significant local weather is discussed. The experiment is based on the search for optimal prescriptors and collection of prescriptands by means of historical data stored on magnetic tape. A five step program to pick out the best correlated presciptors by regression analysis is described. ESA

N77-18684# National Weather Service, Silver Spring, Md.
STATISTICAL FORECASTING OF LOCAL WEATHER FROM NUMERICAL PROGNOSES
William H. Klein *In* WMO Interpretation of Broad-Scale NWP Prod. for Local Forecasting Purposes Oct. 1976 p 85-92 refs (For primary document see N77-18671 09-47)
Copyright. Avail: NTIS HC A13/MF A01; WMO, Geneva

Two techniques for obtaining forecasts of local weather elements by statistical methods are described. The first or perfect prog method specifies local weather from multiple regression equations which are derived from observed circulation parameters but applied to numerical prognoses. The second - Model Output Statistics (MOS) - involves archiving output from numerical models and correlating this output with the observed weather. ESA

N77-18685# Alberta Univ., Edmonton.
WEATHER ASSOCIATED WITH A LOW-PRESSURE CENTRE NEAR NATAL
Richmond W. Longley *In* WMO Interpretation of Broad-Scale NWP Prod. for Local Forecasting Purposes Oct. 1976 p 93-99 refs (For primary document see N77-18671 09-47)
Copyright. Avail: NTIS HC A13/MF A01; WMO, Geneva

Pressures for 35 locations centered near Port Elizabeth, South Africa, were abstracted. By means of interdiurnal correlations 40 winter days and 28 summer days having similar pressure patterns were selected. The techniques give information on the weather to be expected for another day with a similar weather map. ESA

N77-18686# Meteorologischer Dienst der DDR, Potsdam (East Germany).
METHOD AND RESULTS OF INTERPRETATION OF GEOPOTENTIAL FORECASTS
K. Balzer *In* WMO Interpretation of Broad-Scale NWP Prod. for Local Forecasting Purposes Oct. 1976 p 100-106 (For primary document see N77-18671 09-47)
Copyright. Avail: NTIS HC A13/MF A01; WMO, Geneva

The parameterization of the large-scale geopotential field of the 1000 and 500 mb level over Central Europe is described using geopotential fields obtained by analysis at 10 selected grid points forming two squares with a central point. The parameters established by the grid point information were outlined. Analogous cases were used for operational weather forecasting. The principles of the interpretation forecasting are summarized, and its verification and comparison with synoptic forecasts are discussed. Improvements to the analogy method are presented. ESA

N77-18687# Institute of Meteorology and Water Management, Warsaw (Poland).
MEDIUM-RANGE WEATHER FORECAST FOR POLAND BASED ON THE NUMERICAL 72-HOUR FORECAST OF THE 500 mb HEIGHT
M. Wodzinska, H. Sewerynska, and B. Osuchowska-Klein *In* WMO Interpretation of Broad-Scale NWP Prod. for Local Forecasting Purposes Oct. 1976 p 107-112 refs (For primary document see N77-18671 09-47)
Copyright. Avail: NTIS HC A13/MF A01; WMO, Geneva

A method to find a relationship between the forecasted 500 mb height and sea-level pressure patterns based on empirical orthogonal functions analysis is described. A scheme of a five-day weather forecasting procedure on the basis of the 72 hour 500 mb numerical prediction is also outlined. ESA

N77-18688 Meteorological Dept., New Delhi (India).
INTERPRETATION OF MESO-SCALE ACTIVITY FROM SYNOPTIC SCALE FLOW PATTERNS
R. K. Datta, V. S. Tiwari, H. S. Bedi, and B. N. Dewan *In* WMO Interpretation of Broad-Scale NWP Prod. for Local Forecasting Purposes Oct. 1976 p 113-120 refs (For primary document see N77-18671 09-47)
Copyright. Avail: NTIS HC A13/MF A01; WMO, Geneva

Divergence and vorticity values have been computed for four days from 22-25 April 1976 from the flow pattern of thunderstorms. An interpretation of these parameters in respect of the development of local weather phenomena is made. The static energy of the air panel at different stations has been computed and its relation to thunderstorm development presented. ESA

N77-18689# Japan Meteorological Agency, Tokyo.
OBJECTIVE FORECASTING OF HEAVY PRECIPITATION USING NUMERICAL PREDICTION MODEL OUTPUT
R. Tatehira and I. Nakayama *In* WMO Interpretation of Broad-Scale NWP Prod. for Local Forecasting Purposes Oct. 1976 p 121-127 refs (For primary document see N77-18671 09-47)
Copyright. Avail: NTIS HC A13/MF A01; WMO, Geneva

An approach to probability forecasting of heavy precipitation in Japan based on numerical predictions is described. Following an outline of the data used in the study the correlation coefficients between the occurrence of heavy precipitation and the predictors (products from the numerical prediction at the projection time of 24 hours) at the grid points are discussed. Development of a regression equation is discussed together with the orographic rain index. ESA

N77-18690# Technical Univ. of Warsaw (Poland). Inst. of Environmental Engineering.
THE PREDICTION OF AIR MASS-THUNDERSTORMS AND HAILS
Z. Litynska, J. Parfiniewicz, and H. Piwkowski *In* WMO Interpretation of Broad-Scale NWP Prod. for Local Forecasting Purposes Oct. 1976 p 128-130 refs (For primary document see N77-18671 09-47)
Copyright. Avail: NTIS HC A13/MF A01; WMO, Geneva

On the basis of an automated data processing system, statistical and dynamic techniques were combined to produce forecasts of thunderstorms and hails. The 24-hour numerical prediction charts of geopotential for 800, 700 and 500 mb were used for computing the trajectory and the evaluation of air mass source area. Statistical models of forecasting thunderstorms and hails were also applied, using TEMP data available for the source areas. ESA

N77-18691# Hydrometeorological Centre of the USSR (Moscow).
A NUMERICAL SYNOPTIC-HYDRODYNAMIC SCHEME FOR PREDICTION OF CONTINUOUS AND SHOWERY PRECIPITATION
I. A. Petrichenko and B. D. Uspensky *In* WMO Interpretation of Broad-Scale NWP Prod. for Local Forecasting Purposes Oct. 1976 p 131-140 refs (For primary document see N77-18671 09-47)
Copyright. Avail: NTIS HC A13/MF A01; WMO, Geneva

The prediction of precipitation by the combination of analytical and empirical approaches is described. It comprizes the forecasting of the pressure field, the temperature and humidity of air, taking into account diabatic changes or some convection parameters in the atmospheric boundary layer, condensation processes etc. Some results of recent investigations using the method carried out at the Hydrometeorological Center, U.S.S.R. are reported. ESA

N77-18692# Japan Meteorological Agency, Tokyo.
THE OPERATIONAL SIGNIFICANT WEATHER CHART CALCULATION AND DRAWING BY MACHINES IN THE JAPAN METEOROLOGICAL AGENCY
Masatake Kikuchi *In* WMO Interpretation of Broad-Scale NWP Prod. for Local Forecasting Purposes Oct. 1976 p 141-149 refs (For primary document see N77-18671 09-47)
Copyright. Avail: NTIS HC A13/MF A01; WMO, Geneva

The computerized compilation of significant weather charts twice daily on a routine basis is described. The charts are computed and drawn, one over the Asiatic and the other over the Pacific region and broadcast by facsimile. The principles of preparing the charts and the data used are outlined. Problems in the handling of certain meteorological parameters are noted. ESA

N77-18693# National Meteorological Center, Washington, D.C.
MODELLING AND THE MAN-MACHINE MIX AT THE NATIONAL METEOROLOGICAL CENTER
John A. Brown, Jr. *In* WMO Interpretation of Broad-Scale NWP Prod. for Local Forecasting Purposes Oct. 1976 p 151-158 refs (For primary document see N77-18671 09-47)
Copyright. Avail: NTIS HC A13/MF A01; WMO, Geneva

A brief history of the man machine mix at the National Meteorological Center, Washington, is described together with a description of the Center's system as it exists today. A general status report on the modeling development effort with special emphasis on regional modeling is discussed. Future prospects are considered. ESA

N77-18694# Atmospheric Environment Service, Downsview (Ontario).
THE DEVELOPMENT OF A COMPUTERIZED FORECAST SYSTEM
J. Clodman *In* WMO Interpretation of Broad-Scale NWP Prod. for Local Forecasting Purposes Oct. 1976 p 159-166 (For primary document see N77-18671 09-47)
Copyright. Avail: NTIS HC A13/MF A01; WMO, Geneva

The basic concepts of a Canadian approach to the question of automated weather forecasting are outlined followed by a description of the design logic, volume of output and evolutionary development. A computerized forecast system designed to support oil drilling in the Beaufort Sea is also described. ESA

N77-18695# World Meteorological Organization, Geneva (Switzerland).
WEATHER 70: AN AUTOMATED WEATHER SERVICE SYSTEM
Bengt O. Soederberg (Swedish Mil. Weather Service) *In its* Interpretation of Broad-Scale NWP Prod. for Local Forecasting Purposes Oct. 1976 p 167-169 (For primary document see N77-18671 09-47)
Copyright. Avail: NTIS HC A13/MF A01; WMO, Geneva

An automated weather service system for the Swedish Military Weather Service is described. The parameters required to be acquired are outlined together with the ADP system facilities and programs. The role of numerical weather prediction in the system is discussed. ESA

N77-18696# Meteorological Office, Bracknell (England).
THE 'MAN-MACHINE MIX' AT RMC BRACKNELL
A. Woodroffe *In* WMO Interpretation of Broad-Scale NWP Prod. for Local Forecasting Purposes Oct. 1976 p 170-175 ref (For primary document see N77-18671 09-47)
Copyright. Avail: NTIS HC A13/MF A01; WMO, Geneva

Two versions of a 10-level primitive equator model for forecasting surface pressure, wind and weather over the British Isles are briefly described. Both versions produce certain characteristic errors with the result that the human forecaster can often effect significant improvements in the isobaric patterns prior to prognosis interpretation in terms of actual weather. The procedures found useful in facilitating critical examination of the numerical output are discussed. ESA

N77-18697# Japan Meteorological Agency, Tokyo. Electronic Computation Center.
A MANUAL PROCEDURE FOR MODIFICATION OF NUMERICAL FORECASTS
Yoshinobu Masuda *In* WMO Interpretation of Broad-Scale NWP Prod. for Local Forecasting Purposes Oct. 1976 p 176-184 refs (For primary document see N77-18671 09-47)
Copyright. Avail: NTIS HC A13/MF A01; WMO, Geneva

A detailed summary of the manual procedures for modifying numerical prognoses proposed for use by forecasters in local meteorological observatories in Japan is given. To illustrate the procedures they are applied to the 24 hour prognosis at 1200 GMT 9 May 1976. ESA

N77-18698# New Zealand Magnetic Survey, Christchurch.
HUMAN INTERVENTION IN NUMERICAL WEATHER PREDICTION OVER THE DATA SPARSE SOUTHERN OCEAN
K. E. Trenberth and A. A. Neale *In* WMO Interpretation of Broad-Scale NWP Prod. for Local Forecasting Purposes Oct. 1976 p 185-192 refs (For primary document see N77-18671 09-47)
Copyright. Avail: NTIS HC A13/MF A01; WMO, Geneva

In the Southern Hemisphere where sophisticated NWP models suffer from the absence of a good data coverage, a model of lesser sophistication can be used to advantage and produce three analysis - prognosis cycles to test the sensitivity of the prognoses to reasonable alternate analyses in data blank regions. The approach being taken in New Zealand is outlined and the major steps delineated. Points of analysis, especially in the use of satellite pictures, are considered as well as the bogusing of data, and the interpretation of the prognosis to produce an actual forecast for local areas. The technique is illustrated with a case study. ESA

N77-18699 Indian Meteorological Dept., New Delhi. Regional Meteorological Centre.
DERIVATION OF SPOT WINDS FROM THE NUMERICAL FORECASTS PRODUCED ON THE BASIS OF THE QUASI-GEOSTROPHIC MODEL
P. S. Pant, Y. Ramanathan, and R. K. Bansal *In* WMO Interpretation of Broad-Scale NWP Prod. for Local Forecasting Purposes Oct. 1976 p 193-197 refs (For primary document see N77-18671 09-47)
Copyright. Avail: NTIS HC A13/MF A01; WMO, Geneva

A quasi-geostrophic model used for predicting the winds in the middle and upper troposphere is described. The data utilized is noted and the vectorial differences between forecast, realized and actual reported geostrophic wind for July and November 1975 is presented. ESA

N77-18700# Savezni Hidrometeoroloski Zavod, Belgrade (Yugoslavia).
IMPROVEMENT OF PROGNOSTIC CHARTS BY INTRODUCING A SEMI-SUBJECTIVE PROCEDURE INTO THE NUMERICAL MODEL
P. Gburcik *In* WMO Interpretation of Broad-Scale NWP Prod. for Local Forecasting Purposes Oct. 1976 p 198-204 refs (For primary document see N77-18671 09-47)
Copyright. Avail: NTIS HC A13/MF A01; WMO, Geneva

Over the Balkan peninsula most numerical models have a systematic error due to strong orographic influences. The orographic induced errors are rather stable and change slowly with time - error patterns over flat land seem to obey specific principles. The results of investigations show that it is in principle possible to determine regularities in the behavior of the fields of absolute errors. These regularities make it possible to forecast future error fields. ESA

N77-18701# Norwegian Meteorological Inst., Blindern.
USE OF NUMERICAL GUIDANCE IN SUBJECTIVE 24-HOUR FORECASTS OF SURFACE PRESSURE DISTRIBUTION
Knut A. Bjoerheim and Sigbjoern Groenaas *In* WMO Interpretation of Broad-Scale NWP Prod. for Local Forecasting Purposes Oct. 1976 p 205-212 refs (For primary document see N77-18671 09-47)
Copyright. Avail: NTIS HC A13/MF A01; WMO, Geneva

Simple experiments during the winter 75-76 are described where 30 hr objective forecasts of surface pressure distribution were corrected by assessing the errors in the first six hours of the model development. No information other than products from the model system and subjective surface analyses were used. Altogether 40 such forecasts were made and compared to an operational Norwegian product. The experiments support the conclusion that the best forecasts are obtained by careful, systematic use of numerical guidance as opposed to independent forecasting in competition with the computer. ESA

N77-18702# Meteorological Office, Bracknell (England).
THE INTERPRETATION AND PRESENTATION OF NUMERICAL FORECAST DATA
P. G. Wickham *In* WMO Interpretation of Broad-Scale NWP Prod. for Local Forecasting Purposes Oct. 1976 p 213-221 (For primary document see N77-18671 09-47)
Copyright. Avail: NTIS HC A13/MF A01; WMO, Geneva

Following a brief resume of the dissemination of numerical forecasts, the presentation of these to Dependant Forecasting Offices is discussed. The interpretation of numerical data at DFOs is reported together with the presentation of automatic forecasts to the general public. ESA

N77-18703# Bureau of Meteorology, Melbourne (Australia).
AUSTRALIAN EXPERIENCE IN THE OPERATIONAL APPLICATION OF OUTPUT FROM NUMERICAL MODELS
P. Noar, R. Falconer, and L. Guymer *In* WMO Interpretation

of Broad-Scale NWP Prod. for Local Forecasting Purposes Oct. 1976 p 223-231 refs (For primary document see N77-18671 09-47)
Copyright. Avail: NTIS

The Melbourne NWP system, designed for basically broadscale analysis and prognosis, is described. To achieve maximum effectiveness of the centralized system, efforts are made to tailor the output by manual modifications in a form suitable for direct use in local forecasting offices. Three examples of this process are outlined. ESA

N77-18704# Freie Univ., Berlin (West Germany).
THE QUALITY OF THE DAILY LOCAL WEATHER FORECAST
H. Malberg *In* WMO Interpretation of Broad-Scale NWP Prod. for Local Forecasting Purposes Oct. 1976 p 232-236 refs (For primary document see N77-18671 09-47)
Copyright. Avail: NTIS HC A13/MF A01; WMO, Geneva

A verification scheme of 24 and 36 hour weather forecasts based on the 6 hourly checking of wind speed and cloud cover and the 12 hourly checking of precipitation and temperature is described. ESA

N77-18705# Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
DAILY FORECASTS OF LOCAL MAXIMUM TEMPERATURE
H. Malberg *In* WMO Interpretation of Broad-Scale NWP Prod. for Local Forecasting Purposes Oct. 1976 p 237-240 refs (For primary document see N77-18671 09-47)
Copyright. Avail: NTIS HC A13/MF A01; WMO, Geneva

A statistical forecast method for the maximum temperature on fair days is described. The investigation was based on all fair days within a period of ten years - about 300 cases. For each case the vertical temperature profile from the ascents at 00 GMT and 12 GMT were plotted into a tephigram, and the area between the two profiles from the ground to the height where profiles cross each other was determined. ESA

N77-18706# National Center for Atmospheric Research, Boulder, Colo.
SUBJECTIVE QUANTIFICATION OF UNCERTAINTY IN LOCAL WEATHER FORECASTS BASED UPON THE OUTPUT OF NUMERICAL MODELS
Allan H. Murphy *In* WMO Interpretation of Broad-Scale NWP Prod. for Local Forecasting Purposes Oct. 1976 p 241-250 refs (For primary document see N77-18671 09-47)
Copyright. Avail: NTIS HC A13/MF A01; WMO, Geneva

Some recent results of operational and experimental programs in which U.S. National Weather Service forecasters have expressed the uncertainty inherent in such forecasts in probabilities terms are described. The following programs are summarized: nationwide operational precipitation probability forecasting program; point and area forecasts of precipitation probabilities; temperature forecasts. ESA

N77-18707# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
14811A LANCE MISSILE NUMBER 3205, ROUND NUMBER 283 ART (22 JULY 1976) Meteorological Data Report
Jul. 1976 37 p
(DA Proj. 1T6-65702-D-127)
(AD-A029160; DR-921) Avail: NTIS MF A01 CSCL 04/2

Meteorological data gathered for the launching of 14811A Lance, Missile Number 3205, Round Number 283 APT, are presented in tabular form. Author (GRA)

N77-18708# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
12814 LANCE MISSILE NUMBER 3796, ROUND NUMBER 282 RPT (15 JULY 1976) Meteorological Data Report
Jul. 1976 36 p
(DA Proj. 1T6-65702-D-127)
(AD-A029159; DR-920) Avail: NTIS MF A01 CSCL 04/2

Meteorological data gathered for the launching of 12814 Lance, Missile Number 3796, Round Number 282 RPT, are presented in tabular form. Author (GRA)

N77-18709# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
14814 LANCE MISSILE NUMBER 3203, ROUND NUMBER 281 APT (15 JULY 1976) Meteorological Data Report
Jul. 1976 40 p
(DA Proj. 1T6-65702-D-127)
(AD-A029158; DR-919) Avail: NTIS MF A01 CSCL 04/2

Meteorological data gathered for the launching of 14814 Lance, Missile Number 3203, Round Number 281 APT, are presented in tabular form. Author (GRA)

N77-18710# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
12818 LANCE MISSILE NUMBER 2211, ROUND NUMBER 280 RML (13 JULY 1976) Meteorological Data Report
Jul. 1976 42 p refs
(DA Proj. 1T6-65702-D-127)
(AD-A029157; DR-918) Avail: NTIS MF A01 CSCL 04/2

Meteorological data gathered for the launching of 12818 Lance, Missile Number 2211, Round Number 280 RML, are presented in tabular form. Author (GRA)

N77-18711# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
12813A LANCE MISSILE NUMBER 3075, ROUND NUMBER 279 ACL (9 JULY 1976)
Jul. 1976 28 p
(DA Proj. 1T6-65702-D-127)
(AD-A029156; DR-917) Avail: NTIS MF A01 CSCL 04/2

Meteorological data gathered for the launching of 12813A Lance, Missile Number 3075, Round Number 279 ACL, are presented in tabular form. Author (GRA)

N77-18712# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
12813A LANCE MISSILE NUMBER 2160, ROUND NUMBER 276 ECL Meteorological Data Report
Apr. 1976 35 p
(DA Proj. 1T6-65702-D-127)
(AD-A029154; DR-910) Avail: NTIS HC A03/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 12813A Lance, Missile Number 2160, Round Number 276 ECL, are presented in tabular form. Author (GRA)

N77-18713# Washington Univ., Seattle. Cloud Physics Group.
DYNAMICAL AND MICROPHYSICAL STRUCTURES OF CYCLONIC STORMS IN THE PACIFIC NORTHWEST (THE CYCLES PROJECT) Final Report, 1 Oct. 1973 - 30 Apr. 1976
Peter V. Hobbs, Robert A. Houze, Jr., John D. Locatelli, Paul H. Herzegh, Donald G. Atkinson, Lawrence F. Radke, Richard R. Weiss, and Kumud R. Biswas 23 Apr. 1976 172 p refs
(Contract F19628-74-C-0066; AF Proj. 627A)
(AD-A029438; Cloud-Physics-Research-11; AFGL-TR-76-0010)
Avail: NTIS HC A08/MF A01 CSCL 04/2

Contents: Mesoscale rainbands; Dynamics and cloud microphysics of the rainbands in an occluded frontal system. Case 1: December 19-21, 1973; Dynamics and cloud microphysics associated with an occluded frontal system. Case 2: January 16, 1975; Dynamics and microphysics of stratiform clouds associated with frontal systems; Airborne measurements and observations in cirrus clouds. GRA

N77-18714# Naval Environmental Prediction Research Facility, Monterey, Calif.
A WIND WAVE TROPICAL CYCLONE MODEL FOR THE WESTERN NORTH PACIFIC OCEAN
Samson Brand, Kevin Rabe, and Taivo Laevastu Aug. 1976 23 p refs
(AD-A029717; NEPRF-TP-8-76) Avail: NTIS HC A02/MF A01 CSCL 04/2

A numerical tropical cyclone wind wave model for the western North Pacific is presented, and the results are compared with observational analyses of tropical cyclones. The wind input for the model is based on information that would be readily available or easily derived. The results of this preliminary examination show good agreement between the model sea state output and the observational data. - GRA

N77-18715# Air Force Geophysics Lab., Hanscom AFB, Mass.
OBJECTIVE PREDICTION OF MESOSCALE VARIATIONS OF SENSOR EQUIVALENT VISIBILITY DURING ADVECTIVE SITUATIONS Environmental Research Papers
Donald A. Chisholm 23 Jun. 1976 32 p refs
(AF Proj. 8628)
(AD-A030332; AFGL-TR-76-0132; AFGL-ERP-569) Avail: NTIS HC A03/MF A01 CSCL 04/2

The Hanscom AFB mesonetwork was established to examine the potential forecasting benefits to be derived from automated mesoscale observations. Experiments were set up to evaluate three objective procedures for prediction short-period (15 to 60 min) fluctuations in sensor equivalent visibility against a specialized conditional climatology model. The procedures evaluated were: a translation technique based on vectors determined by tracking mesoscale disturbances objectively, an advection technique which utilized forecast wind fields from a limited-area fine-mesh model, and a simple area-averaged trend technique. Data from 24 episodes of reduced visibility gathered during the 1972-74 period of mesonetwork operations were used to evaluate the techniques. The translation and area-averaged trend technique yielded positive skill relative to the conditional climatology model, while the advection technique did not. Although there were episodes in which the spatial selectivity of the translation technique yielded significant improvements, the trend technique was an overall better forecast indicator, especially when one considers its relative simplicity. GRA

N77-18716# Air Force Geophysics Lab., Hanscom AFB, Mass.
A CLIMATOLOGY OF SELECTED STORMS FOR WALLOPS ISLAND, VIRGINIA, 1971-1975 Environmental Research Papers
Robert O. Berthel 2 Jun. 1976 34 p refs
(AF Proj. 627A)
(AD-A029354; AFGL-ERP-563; AFGL-TR-76-0118; SAMS-4) Avail: NTIS HC A03/MF A01 CSCL 04/2

The SAMS hydrometeor erosion tests, held during the winter storm seasons of 1971 through 1975, have yielded considerable meteorological data concerning the weather situations that were prevalent at the time of each test. The situations have been categorized into three different types and the data under each category have been statistically analyzed to produce the mean values and corresponding standard deviations of many meteorological parameters. The data are presented in both tables and graphs for each category, plus wind speed direction up to 12 km in altitude for all situations. A general description of storm structure is given defining regions of precipitation and zones of transition. An appendix of general climatic data for Wallops Island, Virginia is included. Author (GRA)

N77-18717# Naval Postgraduate School, Monterey, Calif.
CLIMATOLOGICAL WAVE STATISTICS DERIVED FROM FNWC SYNOPTIC SPECTRA WAVE ANALYSES M.S. Thesis. Final Report, Jan. - Jul. 1976
Felix Michael Reynolds and Warren C. Thompson Jun. 1976 143 p refs
(AD-A030040; NPS-58ReTh76061) Avail: NTIS HC A07/MF A01 CSCL 04/2

A summer and winter month of 12-hourly synoptic spectral wave analyses produced by the Fleet Numerical Weather Central, Monterey, California were used to develop three experimental wave climatology formats for a point in the Gulf of Alaska; the analyses were produced by the Spectral Ocean Wave Model at FNWC which computes the wave energy contained in 12 direction bands and 15 frequency bands for a grid point array in the Northern Hemisphere oceans. The gross climatology format displays frequency of occurrence of significant wave height by period and direction, but does not differentiate between sea and swell. The two-dimensional spectral climatology format is a tabulation of the frequency of occurrence of spectral energy in various frequency and direction bands. The one-dimensional spectral format displays the distribution of spectral wave energy over various frequency bands but contains no directional information. Both of the spectral formats appear to have their greatest potential application in resonance response of floating and fixed structures. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N77-18718*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ACOUSTIC TRACKING OF WOODHEAD SEABED DRIFTERS
Robert J. Mayhue and Ray W. Lovelady Washington Mar. 1977 22 p refs
(NASA-TN-D-8392; L-10836) Avail: NTIS HC A02/MF A01 CSCL 08C

An investigation was conducted to determine the feasibility of tracking Woodhead seabed drifters that were instrumented with miniature acoustic transmitters having a range in water in excess of 1.0 n.mi. A trial cruise at the entrance of Delaware Bay, with the R.V. Annandale as the sonar-tracking vessel, verified acoustic communications and positioning of the bottom drifters. A demonstration cruise with the R.V. Annandale was also performed in the New York Bight to attempt to collect information on bottom water movement near the sewage-sluge dump site. Results from the tracking mission in the New York Bight suggested that bottom water currents were negligible near the dump site during the time interval from November 7-12, 1975, and that shipboard sonar tracking of acoustic Woodhead seabed drifters could provide useful Lagragian information on bottom water movement caused by tidal and other nonstorm effects. Author

N77-18719# National Ocean Survey, Rockville, Md.
PERFORMANCE EVALUATION OF GUIDELINE MODEL 8400 LABORATORY SALINOMETER
James E. Boyd Jul. 1976 27 p Prepared for National Oceanographic Instrumentation Center
(PB-259696/3; NOAA-TM-NOS-18; NOAA-76081101) Avail: NTIS HC A03/MF A01 CSCL 08J

The salinometer is designed to offer high accuracy (+ or -0.003 part per thousand) and employs a measurement principle entirely different from that of other available instruments. The investigation included testing for overall accuracy, repeatability, and stability of the conductivity ratio measurements as well as the effects of variations in bath temperature, ambient temperature, and power supply voltage and frequency. The performance of the instrument was found to exceed the published specifications of the manufacturer. Results are presented in detail, notably that the conductivity ratio accuracy was better than + or - 1 part per million equivalent salinity. Graphs and other illustrations are included. GRA

N77-18720# National Oceanic and Atmospheric Administration, Seattle, Wash. Pacific Marine Environmental Lab.
A PROCESSING SYSTEM FOR AANDERAA CURRENT METER DATA
R. L. Charnell and G. A. Krancus Jul. 1976 55 p
(PB-259589/0; NOAA-TM-ERL-PMEL-6; NOAA-76082302) Avail: NTIS HC A04/MF A01 CSCL 08J

The translation is done with an electromechanical system which reads the signal and checks parity of each record. The data are then written on a computer compatible tape for subsequent operations. This tape is then run through the computer, a CDC-6400, for conversion and cleanup. This results in production of a printout of all data, including error analysis, and of an interim data tape. The third segment of the system, editing, is currently being done solely by technicians. The lase phase of processing takes the clean, edited data through several filtering and calculations steps. Output from this phase is a processed data tape for use in future analyses, a summary printout, and a plotted presentation of all data. GRA

N77-18721# National Oceanic and Atmospheric Administration, Silver Spring, Md. Office of Marine Resources.

PROCEEDINGS OF THE MARINE MINERALS WORKSHOP

Sep. 1976 235 p Workshop held in Silver Spring, Md., 23-25 Mar. 1976 Sponsored by Dept. of Commerce

(PB-259494/3; NOAA-76110501) Avail: NTIS HC A11/MF A01 CSCL 08I

Eighty experts from industry, government, academia, and the public were invited to a Marine Minerals Workshop to address marine problems covering a wide spectrum of mineral commodities. The resources addressed included manganese nodules; sand, gravel, and shell; placers; and phosphorite and hard rock. The problems and needs of each resource were examined from four points of view: environmental assessment; and technology development. Recommendations for facilitating the development of a marine mining industry and a description of concerns is also contained in these proceedings. GRA

N77-18722# National Oceanographic Instrumentation Center, Washington, D.C.

TEST AND EVALUATION OF THE INTEROCEAN SYSTEM, INC. MODEL 500 CTD/O(2) pH INSITU MONITOR SYSTEM

Barbara S. Pijanowski Aug. 1976 35 p

(PB-260442/9; NOAA-S/T-76-2211; NOAA-76083102; NOAA-TM-NOS-20) Avail: NTIS HC A03/MF A01 CSCL 08J

Test and evaluation results are reported for a system which is designed to measure temperature, conductivity, depth, dissolved oxygen, and pH to depths of 100 meters. The system is described and manufacturer's specifications are listed along with representative performance data such as accuracy, stability, power variation, and environmental effects for the five parameters. In addition, an extended performance summary is provided which details the history of the system, the modifications required during the course of the testing program, and a list of required replacement parts. GRA

N77-18723# Defence Research Establishment Pacific, Victoria (British Columbia).

ON THE VISIBILITY OF INTERNAL-WAVE-INDUCED PERTURBATIONS IN THE WIND-WAVE FIELD

B. A. Hughes Jan. 1976 50 p

(AD-A029988; DREP-TM-76-1) Avail: NTIS HC A03/MF A01 CSCL 08/3

The pertinent factors are discussed which control the visibility of differentially roughened areas on the sea surface, and an attempt is made to quantify this visibility for particular simple incoming sky radiation fields. The predictions of our simple theoretical model with measurements obtained from photographs are compared in which the wind-wave perturbations were caused by internal wave currents. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N77-18724*# Baylor Univ., Houston, Tex. Immunohematology Research Lab.

ANTI-Ig AUTOANTIBODY AND COMPLEMENT-MEDIATED DESTRUCTION OF NEOPLASTIC CELLS Summary Report, 1 Oct. 1975 - 31 Mar. 1976

Jeremiah J. Towmey 16 Jul. 1976 23 p refs

(Contract NAS9-14820)

(NASA-CR-151206) Avail: NTIS HC A02/MF A01 CSCL 06C

Some immune response are effected through immunoglobulins (Ig), of which five classes have been recognized, namely, IgA, IgD, IgE, IgG, and IgM. Auto-antibodies associated with rheumatoid arthritis, termed rheumatoid factors (RF) react with antigenic determinants on IgG heavy chains. RF has predominant but not complete IgM specificity. This auto-antibody response was not detected in treated patients with primary brain tumors (where tissue is sequestered from the immune system by an intact bloodbrain barrier) or with multiple myeloma where humoral immunity is usually impaired. In addition, the prevalence of RF is not increased with solid tumors prior to initiation of chemotherapy or radiotherapy. It is proposed that RF is related to prior chemotherapy or radiotherapy of tumors anatomically accessible to immunologic tissues capable of antibody responses. A primary IgG response occurs, antigen-antibody complexes form, complexed IgG becomes immunologic, and an RF response results. Author

N77-18725*# Baylor Univ., Houston, Tex. Immunohematology Research Lab.

BIOPROCESSING DEVELOPMENT: IMMUNE/CELLULAR APPLICATIONS: ANTI-Ig AUTOANTIBODY AND COMPLEMENT-MEDIATED DESTRUCTION OF NEOPLASTIC CELLS Final Report, 16 Oct. 1975 - 15 Oct. 1976

Jeremiah J. Twomey 15 Nov. 1976 45 p refs

(Contract NAS9-14820)

(NASA-CR-151207) Avail: NTIS HC A03/MF A01 CSCL 06C

This space bioprocessing contract effort was comprised of four general objectives. These were: (1) the evaluation of current separation processes, (2) the identification of problems relevant to the separation of important biologicals, (3) the identification of ground-based assay methods needed for pre- and postflight analysis of space bioprocessing separation technology; and (4) the establishment of methods to determine the efficiency of space bioprocessing separation procedures. Immunology was deemed advantageous to study the diversity of cells and cell products involved and the extensive interest being given to their separation. Upon recognition of a cellular or molecular agent as foreign to the body, the immune system becomes activated to produce cells whose function is to destroy that agent and cell products whose function is to inactivate the agent and assist in its destruction. Long after the agent is removed from the body, some cells remain in a state of readiness to continue these destructive actions specifically against that agent should further exposure to it occur. This is the basis of acquired immunity to disease. Author

N77-18726# Hohenheim Univ., Stuttgart (West Germany). Dept. of Animal Health.

RAPID BACTERIOLOGICAL DIAGNOSIS SYSTEMS ON PHYSICAL BASIS, NOTING SPLENIC FEVER PROOF [UNTERSUCHUNGEN UEBER BAKTERIOLOGISCHE SCHNELLDIAGNOSE-SYSTEME AUF PHYSIKALISCHER BASIS UNTER BESONDERER BERUECKSICHTIGUNG DES MILZBRAND-NACHWEISES]

Dieter Strauch Bonn DOKZENTBw 1976 175 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung

(BMVg-FBWT-76-15) Avail: NTIS HC A06/MF A01; DOKZENTEw DM 40

A short survey of rapid-diagnosis systems is given. Factors which might have an influence on the spectra of direct-fluorochromated bacteria were compiled from literature. Of the various chambers for measuring bacteria which were tested in preliminary studies, the EDER system proved to be the most effective. The optimal combination of filters for measuring with the micro-spectrograph was determined. The significance and importance of the following factors was examined: background, breadth of slot, focusing, duration of measurement, and the shape and position of the bacteria in the measuring field. Preliminary studies on infrared spectroscopy of bacteria were completed, and samples of these and of the gaschromatic experiments were prepared. Author (ESA)

N77-18727# Haskins Labs., New Haven, Conn.

ALGAL METABOLITE INFLUENCE ON BLOOM SEQUENCE IN EUTROPHIED FRESHWATER PONDS Final Report

Kathleen Irwin Keating Jul. 1976 159 p refs

(Grant EPA-R-801387)

(PB-258445/6; EPA-600/3-76-081) Avail: NTIS HC A08/MF A01 CSCL 08H

Preliminary tests indicate that the inhibition of diatom growth by blue-green algal metabolites may be widespread in freshwater lakes. When the elimination of excessive nutrient inflow is not practical, biological management, or programming, of blooms in eutrophied lakes should be attempted. An hypothetical plan is offered to modify the unsatisfactory conditions in one lake which would cost approximately $500 per annum while providing a

more satisfactory lake from both aesthetic and food chain points of view. GRA

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N77-18728*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SPECULATIONS ON THE CONSEQUENCES TO BIOLOGY OF SPACE SHUTTLE-ASSOCIATED INCREASES IN GLOBAL UV-B RADIATION
M. M. Averner and R. D. MacElroy Jan. 1977 17 p refs
(NASA-TM-X-73200; A-6896) Avail: NTIS HC A02/MF A01 CSCL 06R

Various aspects of the impact of ozone depletion on the biosphere are assessed and discussed. Speculations on the factors which determine the extent and nature of biological damage due to an increased flux of ultra violet light are presented. It is concluded that a complete assessment must consider both direct effects (organisms) as well as indirect effects (ecosystems). The role of computer simulation of ecosystem models as a predictive tool is examined. Author

N77-18729*# Beckman Instruments, Inc., Fullerton, Calif. Advanced Technology Operations.
FEASIBILITY OF A FETAL MEASUREMENT ELECTRODE SYSTEM Final Report
Jan. 1977 25 p refs
(NASA Order T-4777-E)
(NASA-CR-151175; FR-1217-101) Avail: NTIS HC A02/MF A01 CSCL 06B

Findings of the study are summarized and conclude that all monitoring requirements are not currently satisfied. An approach is presented to provide a multiparametric monitoring system through combinations of existing transducers. This monitoring system would be appropriate, not only for intrapartum monitoring, but also for neonatal and adult blood gas evaluations. A literature search was conducted to provide an insight into current state-of-the-art in fetal monitoring. Author.

N77-18730*# Martin Marietta Corp., Denver, Colo.
CARDIOVASCULAR INSTRUMENTATION FOR SPACE-FLIGHT
Roger T. Schappell, John T. Polhemus, and Nicholas J. Ganiaris Dec. 1976 84 p refs
(Contract NAS2-9062)
(NASA-CR-151935) Avail: NTIS HC A05/MF A01 CSCL 06B

The observation mechanisms dealing with pressure, flow, morphology, temperature, etc. are discussed. The approach taken in the performance of this study was to (1) review ground and space-flight data on cardiovascular function, including earlier related ground-based and space-flight animal studies, Mercury, Gemini, Apollo, Skylab, and recent bed-rest studies, (2) review cardiovascular measurement parameters required to assess individual performance and physiological alternations during space flight, (3) perform an instrumentation survey including a literature search as well as personal contact with the applicable investigators, (4) assess instrumentation applicability with respect to the established criteria, and (5) recommend future research and development activity. It is concluded that, for the most part, the required instrumentation technology is available but that mission-peculiar criteria will require modifications to adapt the applicable instrumentation to a space-flight configuration. Author

N77-18731*# Scientific Translation Service, Santa Barbara, Calif.
ULTRASTRUCTURAL AND FUNCTIONAL ANATOMY OF THE VESTIBULE
H. Spoendlin Washington NASA Mar. 1977 21 p refs Transl. into ENGLISH from Rev. Med. (France), v. 17, no. 27, 5 Jul. 1976 p 1439-1448
(Contract NASw-2791)
(NASA-TT-F-17405) Avail: NTIS HC A02/MF A01 CSCL 06P

The elements of the vestibular apparatus comprise two groups of receptors: one for the reception of angular or rectangular acceleration, and the other, the secondary structures whose function is still little known. The vestibular receptors are so organized that they transform the physical message into electrical information of the vestibular nervous flux. This several stage information transfer is discussed. Author

N77-18732*# Battelle Pacific Northwest Labs., Richland, Wash. Dept. of Occupational and Environmental Safety.
REGIONAL MEASUREMENT OF BODY NITROGEN Final Report, 1 Feb. - 31 Oct. 1976
H. E. Palmer 31 Oct. 1976 21 p refs
(Contract NAS9-14248)
(NASA-CR-151200) Avail: NTIS HC A02/MF A01 CSCL 06P

Studies of methods for determining changes in the muscle mass of arms and legs are described. N-13 measurements were made in phantom and cadaver parts after neutron irradiation. The reproducibility in these measurements was found to be excellent and the radiation dose required to provide sufficient activation was determined. Potassium-40 measurements were made on persons who lost muscle mass due to leg injuries. It appears that K-40 measurements may provide the most accurate and convenient method for determining muscle mass changes. Author

N77-18733*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DETECTION OF MICROBIAL INFECTION IN BLOOD AND ANTIBIOTIC DETERMINATIONS Patent Application
Christian G. Schrock (New Engl. Med. Center Hospitals), Jody W. Deming (New Engl. Med. Center Hospitals), Grace L. Picciolo, and Emmett W. Chappelle, inventors (to NASA) Filed 19 Jan. 1977 26 p
(NASA-Case-GSC-12045-1; US-Patent-Appl-SN-760795) Avail: NTIS HC A03/MF A01 CSCL 06B

A method for the rapid detection of bacteria in blood and quick determination of the susceptibilities of various unidentified bacteria contained in blood to one or more antibiotics is described. A bacterial adenosine triphosphate (ATP) assay is carried out after the elimination of interfering cellular elements in blood and non-bacterial ATP to determine whether an infection exists. If an infection does exist, a portion of a blood culture is further processed, including subjecting parts of the portion to one or more antibiotics. Change in bacterial ATP in the parts is determined, again by an ATP assay, to determine whether the unidentified bacteria in the sample are susceptible to the antibiotic or antibiotics under test. Author

N77-18734*# Scientific Translation Service, Santa Barbara, Calif.
PRINCIPLES OF AVIATION AND SPACE MEDICINE
A. A. Lavnikov Washington NASA Mar. 1977 319 p Transl. into ENGLISH of the book "Osnovy Aviats. i Kosmich. Med.," (Moscow), 1975 p 1-359
(Contract NASw-2791)
(NASA-TT-F-17511) Avail: NTIS HC A14/MF A01 CSCL 06E

The effects on the human body of various flight factors are discussed as well as the physiological and hygienic features of aircraft cockpits and breathing equipment. Special treatment is given to features of space flight. Other topics included are matters of hygiene during different climatic conditions, and safe practices in servicing aircraft and materials handling. Author

N77-18735# Texas Inst. for Rehabilitation and Research, Houston. Biostereometrics Lab.
MASS DISTRIBUTION OF THE HUMAN BODY USING BIOSTEREOMETRICS Final Report
R. L. Herron, J. R. Cuzzi, and J. Hugg Wright-Patterson AFB, Ohio AMRL Jun. 1976 203 p refs
(Contracts F33615-74-C-5121; DOT-HS-017-2-315-1A; AF Proj. 7184)
(AD-A029402; AMRL-TR-75-18) Avail: NTIS HC A10/MF A01 CSCL 06/14

Biostereometrics is the spatial and spatio-temporal analysis of biological form and function based on principles of analytic geometry. When applied to humans, it constitutes a modern

approach to anthropometry. A suitable stereometric sensor is used to locate the three dimensional coordinates of points distributed over the body surface. The coordinates serve as input to a digital computer which is programmed to yield permutations of numerical or analog (graphical or physical) outputs as the application requires. In the present study, stereophotogrammetry was used to obtain stereometric data in the form of Cartesian coordinates of six segmented human cadavers. Density data provided by the contractor (AMRL) were then used in conjunction with the stereometric data to generate mass, volume, center of mass and principal moments of inertia about the principal axes of inertia with the aid of an IBM 360-50 digital computer. This study was undertaken to further explore the viability of computing mass distribution from biostereometric data and the best available human density values. GRA

N77-18736# School of Aerospace Medicine, Brooks AFB, Tex.
ENDOCRINE-METABOLIC EFFECTS IN SHORT-DURATION, HIGH-WORKLOAD MISSIONS: FEASIBILITY STUDY Final Report, Oct. 1974 - Dec. 1975
William F. Storm, Bryce O. Hartman, Gabriel P. Intano, and Gregory L. Peters Aug. 1976 13 p refs
(AF Proj. 7930)
(AD-A030524; SAM-TR-76-30) Avail: NTIS HC A02/MF A01 CSCL 05/5

A study was conducted at the USAF Instrument Flight Center to test an augment assembly of measures for assessing the relative merits of various flight instrumentation systems. The USAF School of Aerospace Medicine (SAM) stress battery was included. Although the study was not designed so as to permit an optimized evaluation of the SAM stress battery, the following results were noted: anticipatory stress, mild flight stress, and no habituation across missions. The SAM battery appears to be a useful addition to the flight instrumentation research program. Author (GRA)

N77-18737# Illinois Univ., Urbana-Champaign. Dept. of Psychology.
THE VOCABULARY OF BRAIN POTENTIALS: INFERRING COGNITIVE EVENTS FROM BRAIN POTENTIALS IN OPERATIONAL SETTINGS Progress Report, 1 Jul. 1975 - 1 Jul. 1976
Emanuel Donchin Aug. 1976 227 p refs
(Contract N00014-76-C-0002; ARPA Order 3053; NR Proj. 201-195)
(AD-A029452) Avail: NTIS HC A11/MF A01 CSCL 05/10

This report outlines the experimental progress of the biocybernetics project in FY 1976, describes the facilities of the Cognitive Psychophysiology Laboratory, and outlines directions of current and future research. The separate components of the event related potential (ERP) are described, emphasizing the relation to task relevance, event expectancy, and information content. Also the ability to employ single trial extraction techniques for ERP classification utilizing discriminant analysis is demonstrated. Experimental reports describing these research efforts are included. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N77-18738# San Jose State Univ., Calif. Dept. of Speech-Communication.
DESCRIPTIVE COMMUNICATION STRUCTURE METRICS: A PRELIMINARY LOGICAL AND EMPIRICAL ANALYSIS
Jane A. Edwards and Peter R. Monge Dec. 1975 41 p refs
(Contract N00014-75-C-0445; NR Proj. 170-763)
(AD-A030512; TR-4) Avail: NTIS HC A03/MF A01 CSCL 05/10

A systematic analysis of the descriptive communication structure metrics is seen as a necessary prelude to relating them in research to each other and to non-communication variables. In the absence of such an analysis research involving them would seem to run the risk of either (a) potentially misleading results, or (b) suboptimal use of data. This paper presents a logical and empirical analysis of three structural metrics used to describe the communication behavior of the individual group member. The logical portion of the analysis applies some general issues of index construction to the specific metrics under examination, and questions the utility of the individual connectedness metric for comparisons involving individuals belonging to groups of differing sizes. The empirical portion reports the results of a commonality analysis, showing the degree to which each of the metrics reflects the unique or common effects of the individual's total number of reciprocated links, the individual's total number of reciprocated within group links, the proportion of the individual:s total that are within group links and the number of people in the group to which the individual belongs. Author (GRA)

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N77-18739*# Martin Marietta Corp., Denver, Colo.
PAYLOAD CREW ACTIVITY PLANNING INTEGRATION. TASK 2: INFLIGHT OPERATIONS AND TRAINING FOR PAYLOADS
F. R. Hitz 23 Dec. 1976 78 p refs
(Contract NAS9-14676)
(NASA-CR-151187) Avail: NTIS HC A05/MF A01 CSCL 05E

The primary objectives of the Payload Crew Activity Planning Integration task were to: (1) Determine feasible, cost-effective payload crew activity planning integration methods. (2) Develop an implementation plan and guidelines for payload crew activity plan (CAP) integration between the JSC Orbiter planners and the Payload Centers. Subtask objectives and study activities were defined as: (1) Determine Crew Activity Planning Interfaces. (2) Determine Crew Activity Plan Type and Content. (3) Evaluate Automated Scheduling Tools. (4) Develop a draft Implementation Plan for Crew Activity Planning Integration. The basic guidelines were to develop a plan applicable to the Shuttle operations timeframe, utilize existing center resources and expertise as much as possible, and minimize unnecessary data exchange not directly productive in the development of the end-product timelines. Author

N77-18740*# Massachusetts Inst. of Tech., Cambridge. Man-Vehicle Lab.
INTEGRATION OF VISUAL AND MOTION CUES FOR FLIGHT SIMULATOR REQUIREMENTS AND RIDE QUALITY INVESTIGATION Semiannual Progress Report, Jun. - Dec. 1976
L. R. Young Dec. 1976 107 p
(Grant NGR-22-009-701)
(NASA-CR-149667) Avail: NTIS HC A06/MF A01 CSCL 05E

Investigations for the improvement of flight simulators are reported. Topics include: visual cues in landing, comparison of linear and nonlinear washout filters using a model of the vestibular system, and visual vestibular interactions (yaw axis). An abstract is given for a thesis on the applications of human dynamic orientation models to motion simulation. Author

N77-18741*# Life Systems, Inc., Cleveland, Ohio.
TECHNOLOGY ADVANCEMENT OF THE STATIC FEED WATER ELECTROLYSIS PROCESS Annual Report
F. C. Jensen and F. H. Schubert Jan. 1977 59 p refs
(Contract NAS2-8682)
(NASA-CR-151934; LSI-ER-265-11) Avail: NTIS HC A04/MF A01 CSCL 06K

Some results are presented of a research and development program to continue the development of a method to generate oxygen for crew metabolic consumption during extended manned space flights. The concept being pursued is that of static feed water electrolysis. Specific major results of the work included: (1) completion of a 30-day electrode test using a Life Systems,

Inc.-developed high performance catalyst. During startup the cell voltages were as low as 1.38 V at current densities of 108 mA/sq cm (100 ASF) and temperatures of 355 K (180 F). At the end of 30 days of testing the cell voltages were still only 1.42 V at 108 mA/sq cm, (2) determination that the Static Feed Water Electrolysis Module does not release an aerosol of the cell electrolyte into the product gas streams after a break-in period of 24 hours following a new electrolyte charge, and (3) completion of a detailed design analysis of an electrochemical Oxygen Generation Subsystem at a three-man level (4.19 kg/day (9.24 lb/day) of oxygen). Author

N77-18742# National Swedish Road and Traffic Research Inst., Linkoeping.

THE RATING AND MEASURING OF ROAD ROUGHNESS

Georg Magnusson and Peter W. Arnberg 1976 50 p refs Sponsored by Natl. Swed. Road Admin.

(VTI-83-A) Avail: NTIS HC A03/MF A01

A study has been carried out aiming, in part, to elucidate the significance of road roughness for road-users' experience of comfort and, in part, to find an objective method for measuring road roughness, giving data which are directly comparable with the road-users' experience of comfort. Thirty subjects in the preliminary experiment and forty in the main experiment rated their experience of comfort on twenty road sections representing varying degrees of smoothness to roughness conditions. The ratings were carried out in passenger cars, trucks and in a bus. Two kinds of ratings were made: an estimation of the general experience of discomfort when the road sections were compared with one another and a general estimation of what was considered to be an acceptable level of discomfort in different specified situations (e.g., on different types of roads, while traveling at different speeds, and while traveling for different lengths of time). The results of the ratings were partly used to evaluate the appropriateness of the ISO comfort standard in connection with road use and partly to evaluate four different kinds of road meters. Three of the four road meters which were used produced results well in accordance with the results from the subjective ratings. Due to measuring and evaluating techniques, however, only one of these can be recommended for more extensive measurements involving road building and road maintenance. Author (ESA)

N77-18743# Institut fuer Informationsverarbeitung in Technik und Biologie, Karlsruhe (West Germany).

PERFORMANCE OF AN OBSERVER IN REAL TIME RECONNAISSANCE [UNTERSUCHUNG DER LEISTUNGS-FAEHIGKEIT EINES BEOBACHTERS BEI ECHTZEITAUF-KLAERUNG]

Alwin Guedesen and Hans Joachim Reinig Bonn DOKZENTBw 1976 132 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung

(BMVg-FBWT-76-5) Avail: NTIS HC A07/MF A01; DOKZENTBw DM 40

TV-operator efficiency in real time reconnaissance missions was investigated. Efficiency is defined as recognition error rate and recognition time. Both variables depend on various parameters of which the most important were examined. Those are picture resolution, influence of contrast, and disturbing backgrounds. Quantitative results and influences of parameters on operator efficiency are presented graphically. Recognition experiments were carried out by 20 untrained test persons. Their increasing performance by continuous training is considerable. This was studied quantitatively. Experiments were started using fixed scenes first. The influence of moving pictures on operator efficiency was also studied. No decrease in efficiency is obtained if objects are presented on a TV screen at least one second. The results obtained are discussed in regard to reconnaissance missions by remotely piloted vehicles. The dependence between recognition results and flight parameters was studied and is presented graphically. Author (ESA)

N77-18744# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.

HUMAN PILOT DESCRIBING FUNCTION, REMNANT AND ASSOCIATED INFORMATION FOR PITCH ATTITUDE CONTROL: RESULTS FROM IN-FLIGHT AND GROUND-BASED TRACKING EXPERIMENTS

M. F. C. VanGool and H. A. Mooij Sep. 1975 86 p refs refs HCA05/MF A01

(Contract NIVR-RB-1745)

(NLR-TR-75062-U) Avail: NTIS

Servo-analysis techniques, using mathematical models of human control behavior, are effectively used in studies of the system formed by the human pilot and the flight control system/aircraft combination. Measurement and data analysis techniques for the determination of pilot describing function, remnant, and associated information needed in servo-analysis, are described. Results obtained from three compensatory tracking experiments (in-flight and ground based) are presented. Comparisons with results of similar investigations, published in the literature, are made. Author (ESA)

N77-18745# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.

INVESTIGATION ON A PASSENGER RIDE-COMFORT IMPROVEMENT SYSTEM WITH LIMITED CONTROL SURFACE ACTUATOR PERFORMANCE FOR A FLEXIBLE AIRCRAFT

L. J. J. Erkelens and J. Schuring 28 Nov. 1975 85 p refs (Contract NIVR-1752)

(NLR-TR-75140-U) Avail: NTIS HC A05/MF A01

For the low wing-loading aircraft, considered in this investigation, vertical acceleration appeared to be an important factor concerning passenger comfort. To reduce vertical motions, a ride-comfort improvement system was introduced. Determination of parameters of the system, like gains and allowable performance limitations, required analog simulation because of strong nonlinearities. Symmetric aircraft dynamics, ride-comfort improvement system, and atmospheric turbulence were represented by mathematical models. The aircraft's model consisted of two rigid body and three structural modes. The ride-comfort improvement system comprised fast-moving auxiliary flaps, over the entire flap span, commanded by a vertical acceleration sensor. The driving actuators were subject to acceleration, rate, and displacement limits. Vertical atmospheric turbulence was modelled according to the Dryden spectrum. A phugoid instability, appearing in the simulation, required a simple attitude-hold system. A more serious problem was posed by a limit cycle instability due to interference of the wing bending mode with the actuator rate limitation. Decoupling of wing bending motion and flap action was provided by relocation of the acceleration sensor. An optimization of the ride-comfort improvement system was carried out by means of parameter variation and resulted in a satisfactory performance. Reductions in vertical acceleration up to about 50% were obtained, in heavy turbulence, realistic actuator characteristics being included. Author (ESA)

N77-18746# Royal Aircraft Establishment, Farnborough (England).

THE EFFECTS OF 3 HOURS OF VERTICAL VIBRATION AT 5 Hz ON THE PERFORMANCE OF SOME TASKS

R. Gray, R. T. Wilkinson, K. R. Maslen, and G. F. Rowlands Jan. 1976 66 p refs

(RAE-TR-76011; BR52057) Avail: NTIS HC A04/MF A01

A laboratory experiment was conducted to investigate the effect on eight subjects of 3-hour exposures to vertical vibration, and to compare the results with the recommendations for maintaining efficiency of the international standard ISO 2631: Guide for the evaluation of human exposure to whole-body vibration. The vibration used was 5 Hz vertical, with an acceleration level of 1.2 m/sq sec rms, corresponding to the ISO recommended maximum durations of 1 hour for fatigue decreased proficiency and 3 hours for safe exposure. The duration of each session was approximately 3 hours, and four series of four sessions were conducted using two subjects at a time. Four tasks were used, audio vigilance, visual search, compensatory tracking by hand and handwriting. Effects on sight and hearing were checked at the beginning and end of each session. Based on average results, little evidence was found to support the time-dependency of the limits specified for 5 Hz in the international standard in that little fatigue effect was discovered. There was, however, an immediate appreciable decrement in performance of three out of the four tasks as a direct effect of the vibration, suggesting that the short-term nominal limit specified

(2.8 m/sq sec rms for 1-4 min) is too high, for the particular tasks used. Author (ESA)

N77-18747# Navy Experimental Diving Unit, Panama City, Fla.
MODIFIED COLLINS PEDAL-MODE ERGOMETER: DEVELOPMENT AND MEDICAL TESTS Technical Report, 1971 - 1975
Thomas W. James 15 Jun. 1976 51 p
(AD-A028355; NEDU-1-76) Avail: NTIS HC A04/MF A01 CSCL 06/12

Modifications made to the Collins Pedal-Mode Ergometer by NEDU and Battelle from 1971 to 1975 are described, along with a discussion of two predecessor ergometers used by NEDU from the mid 1950's to roughly 1970. Modifications to the commercially available Collins ergometer were performed in order to make the unit watertight and suitable for use at high ambient pressures. This work was accomplished in two phases: first, by NEDU for 1971 to 1972 and later by Battelle from 1973 to 1975. Battelle's final design featured a completely redesigned housing, Bal-Seals and a stainless steel shaft. Medical test conducted with the prototype and final designs are summarized, highlighting the importance of a standard, reliable ergometer in imposing specific diver workloads for a wide array of NEDU equipment and physiological tests. Information on the ergometer control unit, bicycle frames and calibration unit is also provided. GRA

N77-18748# Michigan Univ., Ann Arbor. Highway Safety Research Inst.
AN EVALUATION OF THE 1974 AND 1975 RESTRAINT SYSTEMS Special Report, Jan. 1974 - May 1976
Robert E. Scott, Jairus D. Flora, and Joseph C. Marsh, IV May 1976 178 p refs Sponsored by the Motor Vehicle Manufacturers Assoc. of the US, Inc..
(PB-258585/9; UM-HSRI-76-13) Avail: NTIS HC A09/MF A01 CSCL 13F

Restraint systems in cars demonstrated a substantial capability to reduce the incidence of moderate or worse injury when they were used. Lap belts alone reduce the probability 27% compared to no restraint. The lap and upper torso belts together reduce the probability 21%, compared to no restraint. GRA

N77-18749# Sierra Engineering Co., Sierra Madre, Calif.
ANTHROPOMETRIC TEST DUMMY, MODEL 825-50, DESIGN, DEVELOPMENT AND PERFORMANCE Final Report, 1 Dec. 1972 - 28 Feb. 1975
J. L. Roshala Aug. 1976 245 p
(Contract DOT-HS-254-3-568)
(PB-257179/2; TR-825-900; DOT-HS-801-971) Avail: NTIS HC A11/MF A01 CSCL 13F

The development, manufacture, testing, and evaluation of two (2) 50th percentile male anthropomorphic test dummies are outlined. The objective was to develop a test dummy which could be used for compliance tests with appropriate Federal Motor Vehicle Safety Standards in the evaluation of protection systems for vehicle occupants during real and simulated impact conditions. A further objective was to generate a corresponding test dummy data package which could be made available to any source interested in manufacturing, checking, comparing with other dummy configurations and otherwise verifying the accuracy and precision of the various details. GRA

N77-18750# Hughes Aircraft Co., Culver City, Calif. Dept. of Display Systems and Human Factors.
HUMAN PERFORMANCE EVALUATION OF MATRIX DISPLAYS: LITERATURE AND TECHNOLOGY REVIEW Final Technical Report, Apr. 1974 - Sep. 1975
L. A. Scanlan and W. L. Carel Jun. 1976 205 p refs
(Contract F33615-74-C-4083; AF Proj. 7184)
(AD-A029932; HAC-P75-468; HAC-D1755) Avail: NTIS HC A10/MF A01 CSCL 09/5

In recent years a number of different types of flat-panel displays have been developed which utilize large arrays of discrete display elements for the presentation of symbolic and sensor information. These displays offer several advantages over the conventional cathode ray tube, including reductions in display volume, weight, and power requirements. Included in this class of matrix displays are light emitting diode (LED) arrays, flat panel cathode ray tubes (e.g., the Digisplay). AC plasma and liquid crystal displays. This spectrum of displays allows the designer a new freedom in selecting the most appropriate display type for a given task and environment. To make such decisions successfully, designers need data relating specific display design parameters to measures of system performance. The most critical information that a designer needs concerns those parameters that affect the performance of the operator using the displays. The operator must be able to obtain from the display the information he needs to perform his task(s), to some minimum level of acceptability, under the poorest expected operational circumstances. Little of the mass of literature on display design parameters and human performance research has been oriented to this new class of matrix displays. GRA

N77-18751# Johns Hopkins Univ., Baltimore, Md. Dept. of Psychology.
CONDITIONS FOR IMPROVING VISUAL INFORMATION PROCESSING Final Report
Howard E. Egeth 31 Aug. 1976 20 p refs
(Contract N00014-67-A-0163-0012; NR Proj. 197-017)
(AD-A030425; TR-88) Avail: NTIS HC A02/MF A02 CSCL 05/5

The mission of this contract was to determine how performance in information processing tasks may be optimized. The research spanned five major topics: 1. Performance in visual search and detection tasks. These studies have demonstrated substantial capacity for parallel processing of display elements. 2. Perceptualizing data displays. The use of some unconventional formats for the representation of complex sets of data has been explored. 3. Selective attention. This research on attention is consistent with the notion that attention does not operate at the earliest stages (sensory or perceptual) of information processing, but is restricted to later stages such as memory scanning or response selection. 4. Factors affecting stimulus comparison. The major findings have to do with strategies for comparing stimuli. 5. Short-term memory. Two experiments examined factors that affect the retrieval of well-learned items (digits) from short-term memory. GRA

N77-18752# Johns Hopkins Univ., Baltimore, Md. Dept. of Psychology.
CONDITIONS FOR IMPROVING VISUAL INFORMATION PROCESSING
Howard E. Egeth, H. H. Brownell, L. C. Sager, A. Caramazza, P. Sommers, L. D. Geoffrion, G. C. Gilmore, and P. Whitehouse Aug. 1976 51 p refs
(Contract N00014-67-A-0163-0012; NR Proj. 197-017)
(AD-A029898; TR-84; TR-85; TR-86; TR-87) Avail: NTIS HC A04/MF A01 CSCL 05/10

Four experiments concerned with human information processing are reported. In TR 84 the authors test the proposal that the comparison of a pair of stimuli may in certain circumstances be mediated by the detection of overall vertical symmetry of the pair. The data do not support the conjecture. In TR 85 the authors analyze the frequently reported 'dominance' of visual stimuli over auditory stimuli and find the effect to be nonsensory in origin. In TR 86 the authors apply an incidental memory paradigm in the context of a visual search task to try to determine if processing is exhaustive or self-terminating during search. In TR 87 the authors examine the spatial limits of the ability to attend to relevant information and ignore nearby irrelevant information. GRA

N77-18753# Defense Documentation Center, Alexandria, Va.
PERFORMANCE MEASUREMENTS Report Bibliography, May 1961 - Apr. 1976
Sep. 1976 549 p refs
(AD-A029850; DDC/BIB-76/08) Avail: NTIS HC A23/MF A01 CSCL 05/10

This bibliography contains studies which aid in measuring and assessing data relevant to human performance. Training devices, aptitude and achievement tests, special clothing and equipment are all employed to establish the criteria used in these studies. There are also references on environmental, physical and stress factors, which not only evaluate performance, but under certain conditions may predict it. Corporate Author-

Monitoring Agency, Subject, Title and Personal Author are provided. Author (GRA)

N77-18754# Anacapa Sciences, Inc., Santa Barbara, Calif.
AIRCREW TRAINING REQUIREMENTS FOR NAP-OF-THE-EARTH FLIGHT Final Report
Charles A. Gainer and Dennis J. Sullivan Aug. 1976 - 57 p refs
(Contract DAHC19-73-C-0059; DA Proj. 2Q1-62107-A-745; DA Proj. 2Q7-64715-A-757)
(AD-A030420; ARI-RR-1190; Rept-203-1) Avail: NTIS HC A04/MF A01 CSCL 05/9

In nap-of-the-earth (NOE) flight a helicopter moves at less than treetop height and at variable airspeeds, using natural features for concealment--a dangerous procedure requiring great skill in flying and in navigation. This report identifies specific areas in which NOE training might be improved. Information from agencies and operational units provided data for analysis of NOE mission requirements, aircrew task analyses, and performance requirements for emergencies. Training objectives derived from the analyses were verified, compared with existing NOE training programs, and used to suggest improvements. Problems in navigation and orientation are the major hazard in NOE flight, and training improvements should concentrate in these areas. Suggestions for ground-based training aids are visual (cinematic) simulation, a map-interpretation manual for NOE use, and techniques of ground-level orienteering. Suggestions for flight-based training are procedures such as more practice in re-orientation, equipment such as map displays, and policies such as flying over more varied terrain. Results of the analyses were validated by ARI's field research program and used as the basis for developing the experimental Map Interpretation Terrain Analysis Course (MITAC) now being evaluated at the Army Aviation School, Fort Rucker, Alabama. Author (GRA)

N77-18755# Air Force Human Resources Lab., Brooks AFB, Tex.
ADVANCED SIMULATION IN UNDERGRADUATE PILOT TRAINING: AN OVERVIEW Final Report, Mar. 1971 - Jul. 1975
Don R. Gum, William B. Albery, and James D. Basinger Dec. 1975 28 p refs
(AF Proj. 1192)
(AD-A030224; AFHRL-TR-75-59(1)) Avail: NTIS HC A03/MF A01 CSCL 05/9

An overview of the entire Advanced Simulation in Undergraduate Pilot Training (ASUPT) program is presented to provide the reader with a general introduction to the research system. The three major components of the ASUPT are summarized, including the basic simulators, visual displays, and computer image generation (CIG) system, and interested readers are referenced to the six other volumes of this technical report for more specific and detailed information. This volume touches upon the highlights of the ASUPT design, development, and testing and includes the general progress of the program from its genesis in 1967 to the final acceptance of the simulator in January 1975. GRA

N77-18756# Kaman Sciences Corp., Colorado Springs, Colo.
STATIC EVALUATION OF AIR CUSHION DEPLOYMENT EFFECTS ON THE MEMORY RETENTION OF THE SOLID STATE DIGITAL RECORDER SYSTEM Final Report
Sep. 1976 29 p ref
(Contract DOT-NHTSA-6-5377)
(PB-259006/5; K-76-64U(R); DOT-HS-802-040) Avail: NTIS HC A03/MF A01 CSCL 13F

A part 572 anthropomorphic dummy containing the solid state digital recorder was subjected to static laboratory air cushion inflation test series. It was determined that over the range of conditions tested, no interaction of electric and magnetic fields generated during the inflation required and the dummy's recorder system occurred. Voltage measurements on and near the air cushion during the inflation required were also made. GRA

N77-18757# Construction Engineering Research Lab. (Army), Champaign, Ill.
CONCEPTUALIZATION OF HABITABILITY EXPRESSIONS FOR THE HABITABILITY DATA BASE Interim Report
T. A. Davis Aug. 1976 62 p refs
(DA Proj. 4A7-62719-AT-03)
(AD-A029661; CERL-TR-D-68) Avail: NTIS HC A04/MF A01 CSCL 13/13

Habitability is defined and documents containing statements on habitability are identified within the context of the Corps of Engineers facility delivery process. This process is described as a cycle of events that includes master planning, construction programming, project development, design, and construction. Three generic and ten specific habitability expressions are conceptualized which relate properties of occupant activities (physical, physiological, and mental) to properties of facilities (dimensions of length, width, light and sound levels, temperature, etc.). Three expressions of cost-effectiveness are conceptualized as ratios of the dollar cost of a facility, facility property, or property categories divided by units of occupant needs for health, safety, performance and satisfactions. Structural, content, and technical assumptions are given, and data categories are defined by example. Further steps toward the development of prototype expressions are outlined. Author (GRA)

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N77-18758*# System Development Corp., Santa Monica, Calif.
SPACE SHUTTLE ORBITER DIGITAL DATA PROCESSING SYSTEM TIMING SENSITIVITY ANALYSIS OFT ASCENT PHASE Final Report, 19 Jul. 1976 - 18 Feb. 1977
J. J. Lagas, J. J. Peterka, and D. A. Becker 18 Feb. 1977 358 p refs
(Contract NAS9-15010)
(NASA-CR-151205; TM-(L)-5813/000/00) Avail: NTIS HC A16/MF A01 CSCL 09B

Dynamic loads were investigated to provide simulation and analysis of the space shuttle orbiter digital data processing system (DDPS). Segments of the ascent test (OFT) configuration were modeled utilizing the information management system interpretive model (IMSIM) in a computerized simulation modeling of the OFT hardware and software workload. System requirements for simulation of the OFT configuration were defined, and sensitivity analyses determined areas of potential data flow problems in DDPS operation. Based on the defined system requirements and these sensitivity analyses, a test design was developed for adapting, parameterizing, and executing IMSIM, using varying load and stress conditions for model execution. Analyses of the computer simulation runs are documented, including results, conclusions, and recommendations for DDPS improvements. Author

N77-18759*# General Electric Co., Philadelphia, Pa.
ONBOARD EXPERIMENT DATA SUPPORT FACILITY (OEDSF): CONCEPTUAL DESIGN STUDY
Sep. 1976 13 p
(Contract NAS9-14651)
(NASA-CR-151181) Avail: NTIS HC A02/MF A01 CSCL 09B

The Onboard Experimental Data Support Facility (OEDSF) is an inflight data processor based on a totally new architecture specifically developed to cost-effectively process the data of Shuttle payloads sensors. Processing data onboard fills the following needs: (1) reduction of data bulk by conversion to information (2)quick-look for evaluation, interactive operation, etc. (3) real-time computation of engineering representation of sensed phenomena. For example. Value of backscatter coefficient (sigma) of a scatterometer as a function of latitude and longitude (4) exploitation of the real-time availability of ancillary data, thereby obviating the need for time-tagging, recording, and recorrelation and (5) providing data or information immediately usable by the experimenter or user. The OEDSF is made up of modular and cascadable matrix processors. Each matrix has been sized to process the data of a full typical shuttle payload. Cost analyses indicate that significant savings are realized by processing data with the OEDSF compared with conventional ground facilities.
Author

N77-18760# Advisory Group for Aerospace Research and Development, Paris (France).
COMPUTER APPLICATIONS
I. J. Gabelman, ed. (RADC, N.Y.) Feb. 1977 87 p refs
(AGARD-AR-100; ISBN-92-835-1237-6) Avail: NTIS HC A05/MF A01

Solid state technical developments and their applications to satisfying NATO military requirements are described. Author

N77-18761*# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
CONSIDERATION OF COMPUTER LIMITATIONS IN IMPLEMENTING ON-LINE CONTROLS M.S. Thesis
Gary K. Roberts Jun. 1976 70 p refs
(Grant NGL-22-009-124)
(NASA-CR-149670; ESL-R-665) Avail: NTIS HC A04/MF A01 CSCL 09B

A formal statement of the optimal control problem which includes the interval of dicretization as an optimization parameter, and extend this to include selection of a control algorithm as part of the optimization procedure, is formulated. The performance of the scalar linear system depends on the discretization interval. Discrete-time versions of the output feedback regulator and an optimal compensator, and the use of these results in presenting an example of a system for which fast partial-state-feedback control better minimizes a quadratic cost than either a full-state feedback control or a compensator, are developed.
Author

N77-18762# California Univ., Livermore. Lawrence Livermore Lab.
MST-80 MICROPROCESSOR TRAINER
Gordon D. Jones 21 May 1976 26 p
(Contract W-7405-eng-48)
(UCID-17145) Avail: NTIS HC A03/MF A01

This trainer is a complete, self-contained microcomputer system housed in a brief case for portability and convenience of use. It utilizes INTEL's 8080A microprocessor and associated support chips. The trainer is designed to allow the student to explore and learn the hardware and software capability of the 8080 microprocessor. It includes a breadboard socket so that experiments can be interfaced to the trainer. This option allows the student to learn both interfacing techniques and programming. A keyboard and numerical display are provided for the student to communicate with the trainer. The keyboard and numerical display can be used with either the octal number system or the hexadecimal number system. ERA

N77-18763# Sandia Labs., Albuquerque, N.Mex.
PROGRAMMABLE CALCULATOR AS A DATA SYSTEM CONTROLLER
A. W. Barth and A. C. Strasburg 1976 6 p Presented at Test Methodology Inform. Exchange Program Conf., Albuquerque, N. Mex., 20 Apr. 1976 Sponsored by ERDA
(SAND-76-5404; Conf-760449-1) Avail: NTIS HC A02/MF A01

Digital data techniques are in common use for analysis of analog information obtained in various tests, and systems have been developed which use a minicomputer as the central controller and data processor. Now, microprocessors allow new design approaches at considerably less cost. An approach to system design is outlined based on the use of a programmable calculator as the data system controller. A block diagram of the calculator-controlled data system is shown. It was found that the programmable calculator provides a viable alternative to minicomputers or microprocessors for the development laboratory requiring digital data processing. 3 figures. ERA

N77-18764# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Section Construction Metallique.
THE GRAPHICAL REPRESENTATION OF NC TAPES. AN APT POST-PROCESSOR
Luc Soete Mar. 1976 65 p Sponsord by Inst. pour l'Encour. de la Rech. Sci. dans l'Ind. et l'Agr.
(CRIF-MC-59) Avail: NTIS HC A04/MF A01

The problem of verifying punched tapes for numerically controlled machine tools is dealt with. Graphical representation of the cutter path is proposed as a solution to the problem. When NC paper tapes are produced by computer using a programming language like APT, a draft of the cutter path can be generated starting from the CL FILE which is the interface between processor and post-processor. This is realized by software while running the APT system. The software to design an APT CL File is described. ESA

N77-18765# Defense Documentation Center, Alexandria, Va.
COMPUTERS IN INFORMATION SCIENCES: REAL TIME. REPORT BIBLIOGRAPHY, JANUARY 1968 - APRIL 1976
Sep. 1976 277 p refs Supersedes DDC-TAS-72-92
(AD-A029825; DDC/BIB-76/06; DDC-TAS-72-92) Avail: NTIS HC A13/MF A01 CSCL 09/2

This bibliography contains unclassified and unlimited references dealing specifically with real time computers in information sciences. Corporate Author-Monitoring Agency, Subject, Title and Personal Author are provided. Author (GRA)

N77-18766# Defense Documentation Center, Alexandria, Va.
COMPUTERS IN INFORMATION SCIENCES: PROGRAMMING LANGUAGE Report Bibliography, Mar. 1968 - Apr. 1976
Sep. 1976 444 p refs Supersedes DDC-TAS-73-4
(AD-A029800; DDC/BIB-76/07; DDC-TAS-73-4) Avail: NTIS HC A19/MF A01 CSCL 09/2

This bibliography contains unclassified-unlimited citations on Programming Language. The four computer-generated indexes provided are Corporate Author-Monitoring Agency, Subject, Title and Personal Author. Author (GRA)

N77-18767# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
THE DESIGN OF A MODULAR LABORATORY FOR CONTROL ROBOTICS M.S. Thesis
Nikhil Malvania Sep. 1976 167 p refs
(Contract N00014-75-C-0661)
(AD-A030418; MIT-LCS-TM-74) Avail: NTIS HC A08/MF A01 CSCL 09/2

Computers have been used for the control of physical processes since the early sixties. In this report, we look at Control Robotics, the procedural control of physical processes. Based upon this new approach, a design for a modular laboratory is proposed. The laboratory consists of a set of experiments which can be synthesized using certain conversion and processing modules. The laboratory also entails the generation of algorithms and programs for each experiment. Experiments are proposed and analyzed, and a common and in a sense, minimal set of hardware modules is selected using a minimax approach. Power, torque, strength, resolution and other requirements for the modules are discussed. A theoretical model is developed for predicting and analyzing the capability of a processor to perform

real-time control. The model is based upon the so-called Earliest Deadline algorithm foe scheduling a number of tasks on a single processor. The model relates the bandwidths of different tasks a processor can perform to the total number of tasks; the average instruction execution time for the processor; and the complexity of its instruction set. This model is used to exhibit and compare the controlling capacities of two processors - Digital Equipment Corporation's PDP 11/45 and Intel 8080. It is also used to predict the processor requirements for the experiments of the proposed modular laboratory. Thesis results include measures of relative power of the tested processors in the context of real-time control, and their capabilities in carrying out the experiments of the proposed laboratory. GRA

N77-18768# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.

TASK SCHEDULING IN THE CONTROL ROBOTICS ENVIRONMENT M.S. Thesis

Aloysius Ka-Lau Mok Sep. 1976 94 p refs
(Contract N00014-75-C-0661)
(AD-A030402; MIT-LCS-TM-77) Avail: NTIS HC A05/MF A01 CSCL 09/2

Scheduling problems involved in Control Robotics, a software approach to control engineering, are studied. The capability of a multiprocessor system to handle tasks with real-time deadlines is investigated according to whether complete or partial a priori knowledge of the deadlines, computation times and frequencies of occurrence of individual tasks is available. A model of preemptive scheduling, the scheduling game is introduced to explore the mathematical relationships for different scheduling situations. A necessary and sufficient condition for scheduling tasks with simultaneous requests or deadlines is derived. Partial solutions and the difficulties involved in scheduling tasks with distributed requests are discussed. It is shown that in the absence of a priori knowledge about the distribution of the requests of the future tasks in time, no globally optimal algorithm is possible. Author (GRA)

N77-18769# Environmental Health Lab., Kelly AFB, Tex.

WATER QUALITY DATA STORAGE AND RETRIEVAL Final Report

Richard A. Virost Jul. 1976 88 p refs
(AD-A030106; EHL(K)-76-4) Avail: NTIS HC A05/MF A01 CSCL 13/2

Medical Service monitoring of environmental water quality as mandated by AFR 19-1 and AFR 19-7 will generate vast amounts of data. A computer data automation system is needed to convert these data into usable information for documenting present pollution levels, for determining the effectiveness of corrective measures, for appraising the character of unique Air Force waste discharges and for monitoring the effects of Air Force operations on the water environment. In this study, the magnitude of the data storage and retrieval requirement and several possible computer systems for handling it were evaluated. The results of this study demonstrate that the Air Force should develop its own water quality data storage and retrieval computer program using a data identification system that is compatible with the EPA STORET system. Inclusion of the water sample analysis data in a Master Data Repository will first require modifications in the current site identification and sample submission procedures of AFR 19-7. GRA

N77-18770# Automatic Data Processing Equipment Selection Office (Navy), Washington, D.C.

COBOL COMPILER VALIDATION SYSTEM (X3.23-1974) ANS COBOL 1974. VOLUME 2: DEBUG MODULE TEST SPECIFICATION

29 Sep. 1976 162 p ref
(AD-A030461) Avail: NTIS HC A08/MF A01 CSCL 09/2

This document, the Debug Module Test Specifications, represents one of 14 volumes comprising the preliminary documentation for the 1974 U. S. Navy COBOL Compiler Validation System (CCVS). The 1974 CCVS will consist of audit routines, their related data, and an execution routine (VP-Routine) which prepares the audit routine for compilation. Each audit routine is a COBOL program which includes many tests and supporting procedures indicating the result of the tests. The audit routines collectively contain all of the features of American National Standard Programming Language COBOL - X3.23-1974 (except for the ENTER statement of the Nucleus module) as specified in Federal Information Processing Standard (FIPS) 21-1. GRA

N77-18771# Michigan Univ., Ann Arbor. Cooley Electronics Lab.

PERSYS: A COLLECTION OF FORTRAN SUBROUTINES TO PRODUCE PERSPECTIVE VIEWS OF DATA SURFACES DEFINED ON RECTANGULAR GRIDS

Gerald N. Cederquist Aug. 1976 53 p refs Prepared for ONR
(AD-A030152; CEL-TM-113; CEL-013514-3-M) Avail: NTIS HC A04/MF A01 CSCL 09/2

The PERSYS routines produce coordinate pairs for the straightline vectors forming a two-dimensional view of a three-dimensional surface. Portions of the surface which are not visible are not drawn. The routines operate on user-supplied samples of the x, y, and z coordinates of the surface to be drawn. To reduce processing time, the routines assume that the data samples are available on a rectangular grid; surfaces represented by randomly scattered points cannot be directly processed by PERSYS. The routines are device-independent in the sense that at execution time, the user must supply the names of subroutines that PERSYS can call to dispose of the coordinate pairs describing the two-dimensional view. GRA

N77-18772# Navy Personnel Research and Development Center, San Diego, Calif.

LOW COST PART-TASK TRAINING USING INTERACTIVE COMPUTER GRAPHICS FOR SIMULATION OF OPERATIONAL EQUIPMENT Technical Report, Jun. 1974 - Jun. 1975

Alice M. Crawford, Richard E. Hurlock, Robert Papilla, and Anthony Sassano Sep. 1976 32 p refs
(AD-A029540; NPRDC-TR-76TQ-46) Avail: NTIS HC A03/MF A01 CSCL 05/9

To investigate the effectiveness of this methodology, operations of the S-3A copilot Integrated Control System (INCOS) panel, involving procedural and simple perceptual motor skills, were selected for subject matter. Computerbased training (CBT) materials used consisted of interactive graphic simulations of appearances and operations of the INCOS panel. One group of students studied INCOS operations with the CBT materials, while another group went through the conventional INCOS training program which involves workbook study and hands-on practice with a high fidelity simulator. Two performance posttests were administered to all students in the simulator. Results showed that CBT students completed significantly more problems and took less time on both performance posttests. There was no significant differences between the performance of the CBT group before hands-on practice with the simulator and that of the conventionally trained group after this practice. The findings suggest that practice with the simulator could be eliminated for this phase of training. It was shown that considerable savings could be made if CBT was implemented in place of the conventional training program. It was concluded that the computer-based simulation had provided training which was not degraded by the absence of hands-on practice with actual equipment and that this is methodology offers potential for low cost, part-task training. Recommendations were made for additional research into training using simulation. Author (GRA)

N77-18773# Defense Dept., Washington, D.C.

RELATIONAL DATA MANAGEMENT

J. H. Popa 28 May 1976 50 p refs
(AD-A029892) Avail: NTIS HC A03/MF A01 CSCL 05/1

The relational model of data is being put forward by many researchers as an improved representation of data over that offered by the current generation of hierarchical and network models. The relational model purports to offer a conceptually simpler representation of data and data relationships as well as to provide a firm theoretical basis upon which to construct high-level user languages. This paper is intended both to present an introduction to the relational data model and to discuss its attendant advantages and disadvantages. Author (GRA)

N77-18774# Alabama Univ., Huntsville. Dept. of Electrical Engineering.
A MICROPROCESSOR SYSTEM FOR AUTOMATIC TESTING Final Report, 15 Oct. 1975 - 14 Jun. 1976
Donald K. Fronek and David G. Green Aug. 1976 67 p refs (Contract DAAG29-76-G-0062)
(AD-A031061; ARO-13594.1-R-EL) Avail: NTIS HC A04/MF A01 CSCL 09/2

The research effort has progressed in four parts: 1. Study existing and projected measurement requirements of the LCSS relative to a resident microprocessor. 2. Design and fabricate a microprocessor system capable of controlling the administrative and logic functions of the LCSS. 3. Develop corresponding software subroutines to support item 2 above. 4. Interface the microprocessor and perform functional testing. This research can be adequately described in two categories - hardware and software. The hardware portion of this Report relates that effort of providing diagrams, descriptions, and prototype models necessary to execute the program as specified by the user. The software that is provided compliments the hardware and provides the execution of logic and arithmetic functions under program control. These large categories will be discussed in detail.
Author (GRA)

N77-18775# Operating Systems, Inc., Woodland, Calif.
FTD EDIT SYSTEM Final Technical Report, Jan. 1974 - Jun. 1976
Ron Case and Lance Berglund Griffiss AFB, N. Y. RADC Aug. 1976 46 p
(Contract F30602-74-C-0094)
(AD-A030509; OSI-R76-009) Avail: NTIS HC A03/MF A01 CSCL 09/2

A 16-terminal, interactive, text processing system is described. The system was designed for post processing of computer translated Russian scientific and technical literature. Sophisticated word processing software is supported on 5 minicomputers organized on 2 levels. A PDP-11/05 at the upper level is the main processor. Below are 4 IMLAC PDS-4 satellite processors, each of which supports 4 display/keyboard units. Functionally, the Edit System is optimized for full text editing of translated Russian text. As well, the system will also support keyboarding of original cyrillic material. This is made possible through an expanded character set which includes 4 separate alphabets: Roman, Cyrillic, math/technical and Greek. Author (GRA)

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N77-18776 General Electric Co., Philadelphia, Pa. Space Sciences Lab.
SOFTWARE DEVELOPMENT DATA EVALUATION LABORATORY
E. L. Gray and P. E. Fowler 19 Jan. 1977 34 p refs
(Rept-77SDS008) Avail: GE Co., Philadelphia, Pa. HC $10.00

Software packages were designed and implemented for data transfer and digital filtering in support of the first phase of development of an interactive digital data processing facility.
Author.

N77-18777# California Univ., Livermore. Lawrence Livermore Lab.
ZONE: A FINITE ELEMENT MESH GENERATOR
Michael J. Burger May 1976 27 p
(Contract W-7405-eng-48)
(UCID-17139) Avail: NTIS HC A03/MF A01

The ZONE computer program is a finite-element mesh generator which produces the nodes and element description of any two-dimensional geometry. The geometry is subdivided into a mesh of quadrilateral and triangular zones arranged sequentially in an ordered march through the geometry. The order of march can be chosen so that the minimum bandwidth is obtained. The node points are defined in terms of the x and y coordinates in a global rectangular coordinate system. The zones generated are quadrilaterals or triangles defined by four node points in a counterclockwise sequence. Node points defining the outside boundary are generated to describe pressure boundary conditions. The mesh that is generated can be used as input to any two-dimensional as well as any axisymmetrical structure program. The output from ZONE is essentially the input file to NAOS, HONDO, and other axisymmetric finite element programs. ERA

N77-18778# Argonne National Lab., Ill.
AUTOMATING MULTIPLE PROGRAM REALIZATIONS
J. Boyle and Marilyn Matz 1976 67 p refs Presented at the 24th M.R.I. Intern. Symp. on Computer Software Eng., New York, 20 Apr. 1976 Supported by ERDA and NSF
(CONF-760471-1) Avail: NTIS HC A04/MF A01

The problem of reducing the cost of developing, validating, and maintaining packages of numerical subroutines is discussed. Where such packages are to be made available in versions tailored to run on several different manufacturers' computers, the problem was attacked by taking advantage of commonality; that is, the number of routines to be handled (and hence the cost) is reduced by creating a kind of prototype for each routine which can be processed automatically to produce the several required machine-tailored versions of that routine. It is shown how these costs can often be further reduced by taking a more general view of commonality. The capabilities of one such system are illustrated by considering in detail a program realization which trades structure for efficiency in some implementations. ERA

N77-18779# Idaho National Engineering Lab., Idaho Falls.
COMCAN: A COMPUTER PROGRAM FOR COMMON CAUSE ANALYSIS
Gary R. Burdick, Neldon H. Marshall, and James R. Wilson May 1976 75 p refs
(Contract E(10-1)-1375)
(ANCR-1314) Avail: NTIS HC A04/MF A01

The computer program, COMCAN, searches the fault tree minimal cut sets for shared susceptibility to various secondary events (common causes) and common links between components. In the case of common causes, a location check may also be performed by COMCAN to determine whether barriers to the common cause exist between components. The program can locate common manufacturers of components having events in the same minimal cut set. A relative ranking scheme for secondary event susceptibility is included in the program. ERA

N77-18780# California Univ., Livermore. Lawrence Livermore Lab.
LLL FAMILY OF ORDINARY DIFFERENTIAL EQUATION SOLVERS
A. C. Hindmarsh Apr. 1976 12 p refs Presented at AFWL Workshop on Stiff Systems of Differential Equations, Albuquerque, N. Mex., 6-7 May 1976
(Contract W-7405-eng-48)
(UCRL-78129; Conf-760327-1) Avail: NTIS HC A02/MF A01

The two groups of programs were developed at LLL for the numerical solution of the initial value problem for systems of ordinary differential equations. The first includes the GEAR package. It is a general purpose, variable-order, automatic ODE solver, with eight different method options covering both stiff and nonstiff problem types. A number of variants of GEAR were also written in order to solve large stiff problems of various types. A newer and smaller group of programs is based on the EPISODE package, which resembles GEAR but is based on totally variable-step formulas. ERA

N77-18781# Northwestern Univ., Evanston, Ill. Dept. of Computer Sciences.
TWO-STEP: USER'S GUIDE (COMPUTER PROGRAM FOR CDC 6400)
Erwin H. Bareiss and Ruth Kobbe Apr. 1976 16 p
(Contract E(11-1)-2280)
(COO-2280-24) Avail: NTIS HC A02/MF A01

A guide for the use of the CDC-6400 Computer Program TWO-STEP for the exact solution of linear matrix equations over the integral domain is given. The rational result is converted into decimal form to 12 decimal places. ERA

N77-18782# Technische Univ., Berlin (West Germany). Inst. fuer Luft- und Raumfahrt.

LINDA 1: A PROGRAM SYSTEM FOR INVESTIGATION OF THE DYNAMIC BEHAVIOR OF RAILWAY VEHICLES [LINDA 1 - EIN PROGRAMMSYSTEM ZUR UNTERSUCHUNG DES DYNAMISCHEN VERHALTENS VON SCHIENENFAHRZEUGEN]

Klaus Knothe and Walter Kik 1976 74 p refs In GERMAN; ENGLISH summary

(ILR-11; ISBN-3-7983-0560-9) Avail: NTIS HC A04/MF A01

A computer program is introduced which helps to establish linearized differential equations of motion schematically for any railway vehicle by an element procedure. Apart from the usual elements like springs, masses, and dampers, rigid connecting elements as well as specific railway vehicle elements (e.g. wheel sets) are introduced. At present, conservative and non-conservative eigenvalues and eigenvectors can be calculated by this program. The graphical output of speed dependent eigenvalues as root loci is demonstrated. Author (ESA)

N77-18783# Graphical Software Ltd., London (England).

STUDY OF LANGUAGES FOR GRAPHICAL PROGRAMMING Final Report

H. U. Lemke (Tech. Univ., Berlin), N. E. Wiseman (Cambridge Univ., Engl.), and A. P. Armit Dec. 1975 66 p refs

(Contract ESOC-654/74-AR)

(ESA-CR(P)-873) Avail: NTIS HC A04/MF A01

Based on requirements for a graphical programming language, available languages were reviewed for possible application. Methods for graphic system design are discussed as well as modelling techniques and graphic system organization. Criteria were developed for assessment of languages to implement the various requirements. The following languages were assessed: ALGOL 68, APL, PASCAL, POP-2, SIMULA 67. None of the languages studied has all the features required, and it is therefore a somewhat subjective matter to select the more suitable. ESA

N77-18784# Marconi Co. Ltd., Chelmsford (England). Mathematical Physics and Circuitry Group.

ANALYTIC TECHNIQUES FOR PROCESSING SIGNAL AND NOISE THROUGH A NON-LINEAR CHANNEL USING MODSIM. VOLUME 2: SOFTWARE DESCRIPTION

S. G. Brazier and B. G. West Apr. 1976 195 p refs 2 Vol.

(Contract ESTEC-2327/74-HP)

(ESA-CR(P)-878-Vol-2) Avail: NTIS HC A09/MF A01

A description is presented of modifications to MODSIM, a simulation program for transmission of a signal through a nonlinear noisy channel, to account for signal behavior. The analytical technique adopted to account for the effect of noise is a polygonial expansion of the nonlinear device characteristics. Specifications of additions to the MODSIM software are given, and a curve-fitting program is described. ESA

N77-18785# Rome Air Development Center, Griffiss AFB, N.Y.

A SOFTWARE RELIABILITY MODELING STUDY

Alan N. Sukert Aug. 1976 153 p refs

(AF Proj. 5581)

(AD-A030437; RADC-TR-76-247) Avail: NTIS HC A08/MF A01 CSCL 09/2

This report describes the first phase of a study initiated to apply several software reliability error prediction models from the literature to error data from a large command and control software project. This error data details the complete error history of this project from the start of validation testing through the end of demonstration testing, and also includes actual operational error data. The actual study involves obtaining predictions from the various models used, and comparing the predicted results with the actual error data history. From these comparisons, analysis to determine the reasons why the predicted results did or did not agree with actual results is performed. This report presents the predicted results, analysis of results, and includes some general comments on overall trends and possible future extensions of this study. Author (GRA)

N77-18786# BDM Corp., Vienna, Va.

CENTRAL FLOW CONTROL SOFTWARE SYSTEMS ANALYSIS. VOLUME 2: DATA BASE SOFTWARE STUDY Final Report

George G. Kershaw and Travis D. Guye Jul. 1976 91 p

(Contract DOT-FA76WA-3792)

(AD-A030352; FAA-RA-76WA-3792-2; FAA-RD-76-160-2) Avail: NTIS HC A05/MF A01 CSCL 09/2

An analysis of the operational requirements of Central Flow Control was made to determine the database structure and database software requirements. This report documents the findings of the analysis in the areas of Database Administration, Database Organization and Access and Data Independence. Author (GRA)

N77-18787# Auburn Univ., Ala. Dept. of Aerospace Engineering.

DEVELOPMENT OF THEORETICAL MODELS AND DESCRIPTION OF COMPUTER PROGRAM, VOLUME 1 Final Report

Kenneth E. Harwell 15 Sep. 1976 78 p refs

(Contract DAAH01-75-C-0121)

(AD-A030380) Avail: NTIS HC A05/MF A01 CSCL 09/2

Numerical computer models for the prediction of aircraft and missile exhaust plume flow fields are described. The flow model is capable of treating multiple shock waves in the exhaust plume. An infrared computer model is described, and typical results are presented for some typical missile exhaust plumes. Author (GRA)

N77-18788# Aerospace Corp., El Segundo, Calif. Engineering Science Operations.

A SIMULATION STUDY OF TSYPKIN'S OPTIMUM, ADAPTIVE QUANTIZER FOR UNKNOWN DATA PROCESSES Interim Report

Lloyd M. Nirenberg 23 Sep. 1976 15 p refs

(Contract F04701-75-C-0076)

(AD-A030354; TR-0076(6901-03)-7; SAMSO-TR-76-204) Avail: NTIS HC A02/MF A01 CSCL 09/2

Tsypkin's algorithm for optimum, adaptive, recursive quantization of data processes with 'a priori' unknown statistics was simulated. Gaussian and random sinewave data types were used. It is shown in this paper how to choose the initial conditions and gain factors, which Tsypkin left incompletely specified in his English reports, so that the algorithm produces quantizers close to the known optimum quantizers. The cases of 2, 4, and 8 levels are demonstrated. To the author's knowledge, this is the first report on an application of the Tsypkin algorithm in the literature. Further study of Tsypkin's algorithm is recommended. Author (GRA)

N77-18789# Army Engineer Topographic Labs., Fort Belvoir, Va.

GENERAL PROGRAMMING ON A PARALLEL PROCESSOR

David L. Ackerman Aug. 1976 15 p refs

(AD-A030102; ETL-0062) Avail: NTIS HC A02/MF A01 CSCL 09/2

This report discusses techniques for creating general programs for the Goodyear Aerospace Corporation STARAN parallel processor. To make efficient use of STARAN, problems should be handled by individual programs. However, general programs are often desired to allow manipulation of input parameters. Two general area correlation routines are used as examples in this report. These routines use variable shifting, variable length masks, and variable input parameters to control the computing algorithm. General programming on the STARAN is more difficult, uses more memory space, executes slower, and does not use array space as efficiently as a specialized program. However, some generalization is desired, and the techniques in this report should help a programmer create a general program. Author (GRA)

N77-18790# Harry Diamond Labs., Adelphi, Md.

NUMERICAL FOURIER TRANSFORM

Alfred G. Brandstein and Egon Marx Sep. 1976 48 p refs

(DA Proj. 1W1-62118-AH-75)

(AD-A030147; HDL-TR-1748) Avail: NTIS HC A03/MF A01 CSCL 09/2

Numerical techniques for the analysis of digitized time-amplitude traces are presented, with special emphasis on Fast

Fourier transforms. Accuracy of computation is improved by the use of linearly interpolated functions; for equispaced input the subprogram FLAT uses the Cooley-Tukey algorithm, while NUFT may be employed for the nonequispaced case. Although FLAT and NUFT can be used to perform inverse Fourier transforms, the special subprograms FLIT and INUFT compute these functions more efficiently. An analysis of the errors introduced by digitization, interpolation, and the computation of Fourier transforms is included. GRA

N77-18791# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

AN EXPLORATORY STUDY OF SOFTWARE COST ESTIMATING AT THE ELECTRONIC SYSTEMS DIVISION M.S. Thesis

Thomas J. Devenny Jul. 1976 163 p refs

(AD-A030162; GSM/SM/76S-4) Avail: NTIS HC A08/MF A01 CSCL 09/2

The estimate of software development cost is the key piece of information in many software management decisions. No technique exists which can consistently produce the reliable and accurate cost estimates which managers need. This thesis research effort explored the software cost estimating process at the Electronic Systems Division of the Air Force Systems Command. The purpose of the research was to provide managers, researchers, and cost estimators with a better insight into the cost estimating process. Data were gathered from 16 major software acqusitions at ESD using both a structured interview and contractor furnished Cost performance Reports. The research findings identified some major problems which are currently inhibiting the development of accurate and reliable software cost estimates. To reduce these problems, recommendations are made to adopt a common cost estimating technique and to modify the use of contractor furnished software cost information. While the research was limited to ESD, the research findings and the recommendations may be applicable to other DoD software acquisition agencies.

Author (GRA)

N77-18792# Naval Ship Research and Development Center, Bethesda, Md. Ship Performance Dept.

COMPUTER PROGRAM FOR ESTIMATION OF EXTREME VALUES BASED ON THE GENERALIZED GAMMA DISTRIBUTION

Michel K. Ochi May 1976 75 p refs

(AD-A030090; SPD-692-01) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report presents a computerized procedure for evaluating the parameters of the generalized gamma distribution from a set of random data following the method proposed by Stacy and Mihram. The computer program includes the estimation of extreme values for a specified number of observations by applying order statistics. Program listings and an example of the application of the method to surface effect ship motion data are included.

GRA

N77-18793# College of William and Mary, Williamsburg, Va. Dept. of Mathematics.

ANALYSIS OF DISSECTION ALGORITHMS FOR VECTOR COMPUTERS

A. George, W. G. Poole, Jr., and R. G. Voigt Aug. 1976 62 p refs

(Contract N00014-75-C-0879; NR Proj. 044-459)

(AD-A029679; TR-13) Avail: NTIS HC A04/MF A01 CSCL 09/2

Recently two dissection algorithms (one-way and incomplete nested dissection) have been developed for solving the sparse positive definite linear systems arising from n by n grid problems. Concurrently, vector computers (such as the CDC STAR-100 and TI ASC) have been developed for large scientific applications. An analysis of the use of dissection algorithms on vector computers dictates that vectors of maximum length be utilized thereby implying little or no dissection; on the other hand, minimizing multiplication counts suggests that considerable dissection be performed. In this paper we discuss the resolution of this conflict by minimizing the total time required by vectorized versions of the two algorithms. Author (GRA)

N77-18794# University of Southern Calif., Marina del Rey. Information Sciences Inst.

ABSTRACT DATA TYPES AND SOFTWARE VALIDATION

John V. Guttag, Ellis Horowitz, and David R. Musser Aug. 1976 51 p refs

(Contract DAHC15-72-C-0308; ARPA Order 2223)

(AD-A029896; ISI/RR-76-48) Avail: NTIS HC A04/MF A01 CSCL 09/2

A data abstraction can be naturally expressed using algebraic axioms, whose virtue is that they permit a representation-independent formal specification of a data type. A moderately complex example is given which shows how to employ algebraic axioms at successive levels of implementation. The major thrust of the paper is two-fold. First, it is shown how the use of algebraic axiomatizations can significantly improve the process of proving the correctness of an implementation of an abstract data type. Second, semi-automatic tools are described which can be used both to automate such proofs of correctness and to derive an immediate implementation from the axioms. This implementation allows for limited testing of a large software system at design time, long before a conventional implementation is accomplished. Extensions to the formalism which permit the handling of errors and procedures with side effects are also given. Author (GRA)

N77-18795# George Washington Univ., Washington, D.C. Program in Logistics.

SENSITIVITY ANALYSIS FOR PARAMETRIC NON-LINEAR PROGRAMMING USING PENALTY METHODS

Robert L. Armacost and Anthony V. Fiacco 30 Jul. 1976 47 p refs

(Contract N00014-75-C-0729; NR Proj. 347-020)

(AD-A031195; Serial-T-340) Avail: NTIS HC A03/MF A01 CSCL 15/5

Recently, it has been shown that a class of penalty function algorithms can readily be adapted to generate sensitivity analysis information for a large class of parametric nonlinear programming problems. In particular, estimates of the partial derivatives (with respect to the problem parameters) of the components of a solution vector and the optimal value function have been successfully calculated for a number of nontrivial examples. The approach has been implemented using the well known Sequential Unconstrained Minimization Technique (SUMT) computer program. This paper, a continuation and amplification of a recent paper by Armacost, gives a detailed summary of the significant underlying theoretical results, reviews recent additions to the computer program that include Lagrange multiplier sensitivity calculations, and elaborates on the kind of information that can be generated by further analyzing and interpreting results obtained in applying the technique to a well known inventory model. Author (GRA)

N77-18796# University of Southern Calif., Los Angeles. Electronic Sciences Lab.

FAILURE-TOLERANT PARALLEL PROGRAMMING AND ITS SUPPORTING SYSTEM ARCHITECTURE

K. H. Kim and C. V. Ramamoorthy (Calif. Univ. Berkeley) 1976 13 p refs Rept. from the Proc. of the 1976 Natl. Computer Conf., p 413-423

(Contract F44620-71-C-0067; Grant NSF GJ-35833; AF Proj. 4751)

(AD-A029926; AFOSR-76-0969TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

The state-of-art in software validation as well as the continuing growth of the size and complexity of software subsystems, makes extra costs paid for software error tolerance more than justified. A program in which procedures for runtime validation and recovery are explicitly specified, is generally called a failure-tolerance program. One problem in failure-tolerant programming, which could be particularly serious in real-time computing environments, is the program execution time increased due to incorporation of validation and recovery procedures. This paper introduces an approach to the solution, called the failure-tolerant parallel programming. The essence of this approach is to maximally overlap main-stream computation with redundant computation oriented for validation and recovery. Subsequently a model system architecture tailored for efficient execution of failure-tolerant parallel programs is described. It is of highly general and modular nature and contains a novel memory subsystem named the duplex

memory. Directions of further researches on program structuring and expansion of the model architecture are also indicated.
Author (GRA)

N77-18797# Stanford Univ., Calif. Systems Optimization Lab.
SOLVING GEOMETRIC PROGRAMS USING GRG RESULTS AND COMPARISONS
M. Ratner, L. S. Lasdon, and A. Jain May 1976 23 p refs
(Contracts N00014-75-C-0267; N00014-75-C-0865;
NR Proj. 047-064; NR Proj. 047-143)
(AD-A030688; SU-SOL-76-1) Avail: NTIS HC A02/MF A01
CSCL 12/2

This paper describes the performance of a general purpose GRG code for nonlinear programming in solving geometric programs. The main conclusions drawn from the experiments reported are: (1) GRG competes well with special purpose geometric programming codes in solving geometric programs and, (2) Standard Time, as defined by Colville, is an inadequate means of compensating for different computing environments while comparing optimization algorithms. Author (GRA)

N77-18798# Stanford Univ., Calif. Optimization Lab.
NONLINEAR PROGRAMMING FOR LARGE, SPARSE SYSTEMS
B. A. Murtagh and M. A. Saunders Aug. 1976 62 p refs
(Contracts N00014-75-C-0267; E(04-3)-326; NR Proj.
047-064)
(AD-A030690; SU-SOL-76-15) Avail: NTIS HC A04/MF A01
CSCL 12/2

An algorithm for solving large-scale nonlinear programs with linear constraints is presented. The method combines efficient sparse matrix techniques as in the revised simplex method with stable variable-metric methods for handling the nonlinearities. A general-purpose production code (MINOS) is described, along with computational experience on a wide variety of problems.
Author (GRA)

N77-18799# Mitre Corp., Bedford, Mass.
A REVIEW OF SOFTWARE COST ESTIMATION METHODS
J. A. Clapp Aug. 1976 51 p refs
(Contract F19628-76-C-0001; AF Proj. 572H)
(AD-A029748; MTR-3264; ESD-TR-76-271) Avail: NTIS
HC A04/MF A01 CSCL 09/2

Software costs are becoming an increasingly larger portion of the cost of major military systems. This report presents the basic problems in estimating the cost of software development. Current strategies for making estimates are summarized and evaluated. Changes in the management of software acquisition and in the software development methods for large defense systems can improve software cost estimation. A number of these changes are identified. Author (GRA)

N77-18800# Army Audit Agency, Falls Church, Va.
ARMY UNIFORM DATA INQUIRY TECHNIQUE (AUDIT). OS OPERATIONS AND SCHEDULING MANUAL, VOLUME 3-OS
31 Jan. 1976 34 p
(AD-A029523; DOD/DF-76/007C-Vol-3-OS;
USACSC-Man-18-1-B-AVB-Vol-3-OS) Avail: NTIS
HC A03/MF A01 CSCL 09/2

AUDIT is a data retrieval system which features a user oriented specification language and precompiler which generates COBOL source programs for compilation and execution in a batch processing environment. Capabilities of AUDIT include: high level user language, field editing, algebraic computation, Boolean selection logic, random sample extraction, statistical analysis of data fields, sorting, report generation, extract file generation, and multiple extraction/reporting per file pass. Source programs and JCL are for IBM 360 OS or DOS configurations, however, the system has been converted by other uses for operation on the Univac 494, Univac Series 70/45, Univac 1108 and Honeywell 6050. The AUDIT OPERATION Manual serves as the primary reference for scheduling and operation of the system. GRA

N77-18801# Army Audit Agency, Falls Church, Va.
ARMY UNIFORM DATA INQUIRY TECHNIQUE (AUDIT). USER'S MANUAL, VOLUME 2
31 Jan. 1976 64 p
(AD-A029521; DOD/DF-76/007A-Vol-2;
USACSC-Man-18-1-B-AVB-Vol-2) Avail: NTIS
HC A04/MF A01 CSCL 09/2
For abstract, see N77-18800.

N77-18802# Army Audit Agency, Falls Church, Va.
ARMY UNIFORM DATA INQUIRY TECHNIQUE (AUDIT). DOS OPERATIONS AND SCHEDULING MANUAL, VOLUME 3-DOS
31 Jan. 1976 31 p
(AD-A029522; DOD/DF-76/007B-Vol-3-DOS;
USACSC-Man-18-1-B-AVB-V-3-DOS) Avail: NTIS
HC A03/MF A01 CSCL 09/2
For abstract, see N77-18800.

62 COMPUTER SYSTEMS

Includes computer networks.

N77-18803# Argonne National Lab., Ill.
MATHEMATICAL SOFTWARE IN THE NETWORK ENVIRONMENT
J. C. T. Pool 1976 22 p refs Presented at the Berkeley Workshop on Distributed Data Management and Computer Networks, Berkeley, Calif., 24-26 May 1976
(Contract W-31-109-eng-38)
(CONF-760550-2) Avail: NTIS HC A02/MF A01

Resource sharing via computer networks is recognized as a possible method for dramatically reducing future software development costs by eliminating duplication of effort and by focusing scarce and geographically scattered expertise on areas of greatest need. The object of this report is to stimulate consideration of existing related experience and plans, and thus to gain insight necessary to define better the mathematical software network experiments. Attributes of mathematical software are outlined, and the role of networks in the development of algorithms and the utilization of mathematical software is examined. The problem of program portability is discussed at some length. ERA

N77-18804# California Univ., Livermore. Lawrence Livermore Lab.
MINICOMPUTER BASED, CONTROLLED MATERIALS INFORMATION SYSTEM
N. Roberts, T. Jessen, O. Meadows, and D. Seibel 1 Jun. 1976
7 p refs Presented at the 17th Ann. Meeting of the Inst. of Nucl. Mater. Management, Seattle, 23 Jun. 1976
(Contract W-7405-eng-48)
(UCRL-78215; Conf-760615-3) Avail: NTIS
HC A02/MF A01

The LLL Materials Management Group and Data Processing Services developed a transaction-oriented, minicomputer system for the management of the Laboratory's controlled materials. The system consists of a multi-vendor hardware system designed for ease of operation, maximum reliability, and quick response and the requirements imposed on the hardware and software systems are discussed. GRA

N77-18805# Defense Communications Agency, Arlington, Va.
ARPANET INFORMATION BROCHURE
Aug. 1976 22 p
(AD-A030009) Avail: NTIS HC A02/MF A01 CSCL 09/2

ARPANET is an operational, resource sharing inter-computer network linking a wide variety of computers in CONUS, Hawaii, Norway, and England. Its communications system introduced the revolutionary technique of packet switching where each message is broken up into small packets and each packet is switched to its destination over the quickest communications path available at any given instant. ARPANET was originally designed under a research and development program by the Defense Advanced Research Projects Agency in 1969. Management responsibility of the network was transfered to Defense Communications Agency on July 1, 1975. This brochure provides a general description of the ARPANET and defines the policies and procedures governing its use. Author (GRA)

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N77-18806*# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.

DIGITAL SIGNAL PROCESSING AND CONTROL AND ESTIMATION THEORY -- POINTS OF TANGENCY, AREA OF INTERSECTION, AND PARALLEL DIRECTIONS

Alan S. Willsky Jan. 1976 340 p refs

(Grants NGL-22-009-124; NSF GK-41647; NSF ENG-76-02860)

(NASA-CR-149662; ESL-R-712) Avail: NTIS HC A15/MF A01 CSCL 12/2

A number of current research directions in the fields of digital signal processing and modern control and estimation theory were studied. Topics such as stability theory, linear prediction and parameter identification, system analysis and implementation, two-dimensional filtering, decentralized control and estimation, image processing, and nonlinear system theory were examined in order to uncover some of the basic similarities and differences in the goals, techniques, and philosophy of the two disciplines. An extensive bibliography is included. Author

N77-18807# Los Alamos Scientific Lab., N.Mex.

FIXED INCREMENT ALGORITHM IN PATTERN RECOGNITION

C. J. Everett and E. D. Cashwell Jun. 1976 5 p

(Contract W-7405-eng-36)

(LA-6428-MS) Avail: NTIS HC A02/MF A01

A detailed proof is given that the fixed increment algorithm of pattern recognition theory succeeds in producing, in a finite number of steps, a set of hyperplanes which separate (with buffer zones) a given finite number of linearly separable, finite sets of vectors. The basic algorithm and theorem have been disentangled from existing proof, and appear as general properties of any inner product space. ERA

N77-18808# Institut fuer Informationsverarbeitung in Technik und Biologie, Karlsruhe (West Germany).

OPTIMIZATION OF IR EQUIPMENT BY SEMIPARALLEL PATTERN PROCESSING [OPTIMIERUNG VON IR-GERAETEN DURCH SEMIPARALLELE MUSTERVERARBEITUNG]

Horst Gudat Bonn DOKZENTBw 1976 40 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung Prepared jointly with Eltro G.m.b.H.

(BMVg-FBWT-76-6) Avail: NTIS HC A03/MF A01; DOKZENTBw DM 30

The development of a system for the recognition of airborne targets is summarized. The image conversion is done by a linear array of infrared detectors. Investigations were focused on the electronic signal processing. A semiparallel processing method was developed which allows an efficient online evaluation of pictures and scenes. The properties of the method and the prototype realized are described. The structure of an optimum detection system based on the semiparallel processing principle is presented. Author (ESA)

N77-18809# Massachusetts Univ., Amherst. Graduate School.

THE USE OF CONTEXT IN CHARACTER RECOGNITION Ph.D. Thesis

Edward G. Fisher Mar. 1976 186 p refs

(Contract N00014-67-A-0230-0007)

(AD-A030381) Avail: NTIS HC A09/MF A01 CSCL 09/2

The recognition of text by machine has been studied for many years. Machine reading of text has long been viewed as a means for eliminating many of the most tedious jobs in our society, such as: computer input of a hundred million tax forms each year; sorting of billions of pieces of mail per year; processing of credit card transaction slips; and sorting all of the checks which must go through a few banks and clearing houses and be charged to the proper account. Checks can be read with fewer than one error per million because all of the printing is done in a single font with magnetic ink by carefully controlled machines. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N77-18810*# Scientific Translation Service, Santa Barbara, Calif.

CONCERNING DIFFERENTIAL INVARIANTS

M. Halphen Washington NASA Feb. 1977 61 p refs Transl. into ENGLISH The doctoral thesis "Sur les invariants differentiels" Paris, Gauthier-Villars, 1878 p 1-57

(Contract NASw-2791)

(NASA-TT-F-17383) Avail: NTIS HC A04/MF A01 CSCL 12A

The differential invariants of ordinary differential equations are analyzed. Equations of order one through nine are considered, and general theorems are derived. It is shown that the integration of an invariant integral equation of order 8 + n reduces to the integration of an n-th order equation and an eighth-order invariant equation. Author

N77-18811*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

IMPLICIT APPROXIMATE-FACTORIZATION SCHEMES FOR THE EFFICIENT SOLUTION OF STEADY TRANSONIC FLOW PROBLEMS

W. F. Ballhaus, A. Jameson (N. Y. Univ.), and J. Albert Jan. 1977 27 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.

(NASA-TM-X-73202; A-6898) Avail: NTIS HC A03/MF A01 CSCL 12A

Implicit approximate-factorization algorithms (AF) are developed for the solution of steady-state transonic flow problems. The performance of the AF solution method is evaluated relative to that of the standard solution method for transonic flow problems, successive line over-relaxation (SLOR). Both methods are applied to the solution of the nonlinear, two-dimensional transonic small-disturbance equation. Results indicate that the AF method requires substantially less computer time than SLOR to solve the nonlinear finite-difference matrix equation for a transonic flow field. This increase in computational efficiency is achieved with no appreciable increase in computer storage or coding complexity. Author

N77-18812*# Texas A&M Univ., College Station. Dept. of Mathematics.

ESTIMATING NORMAL MIXTURE PARAMETERS FROM THE DISTRIBUTION OF A REDUCED FEATURE VECTOR

L. F. Guseman, B. C. Peters, Jr., and Manot Swasdee Nov. 1976 38 p refs

(Contract NAS9-14689)

(NASA-CR-151209; Rept-11) Avail: NTIS HC A03/MF A01 CSCL 12A

A FORTRAN computer program was written and tested. The measurements consisted of 1000 randomly chosen vectors representing 1, 2, 3, 7, and 10 subclasses in equal portions. In the first experiment, the vectors are computed from the input means and covariances. In the second experiment, the vectors are 16 channel measurements. The starting covariances were constructed as if there were no correlation between separate passes. The biases obtained from each run are listed. I.M.

N77-18813# Los Alamos Scientific Lab., N.Mex.

NON-STANDARD ANALYSIS AND INFINITESIMALS: AN ELEMENTARY SURVEY

Basil Nichols May 1976 18 p refs

(Contract W-7405-eng-36)

(LA-6306-MS) Avail: NTIS HC A02/MF A01

A primer is presented in nonstandard analysis. Its historical development is reviewed. Its mathematical highlights are emphasized, notably a concrete construction of hyperreal numbers based on ultrafilters. The deep duality correspondences between classical and nonstandard analysis are outlined, particularly with reference to model theory in mathematical logic. ERA

N77-18814# California Univ., Livermore. Lawrence Livermore Lab.
PROCEDURE FOR THE SOLUTION OF FINITE-DEFORMATION CONTACT-IMPACT PROBLEMS BY THE FINITE ELEMENT METHOD
John O. Hallquist Apr. 1976 46 p refs
(W-7405-eng-48)
(UCRL-52066) Avail: NTIS HC A03/MF A01

A numerical procedure is presented for solving the finite deformation dynamic contact-impact problems by the finite element method. After impact, penetration is precluded by constraint conditions that are imposed by a transformation of the generalized displacements in the equations of motion. Either friction or frictionless interface conditions can be assumed along the contact surface. Five numerical examples are provided to demonstrate the accuracy and the flexibility of the method. ERA

N77-18815# Oak Ridge National Lab., Tenn.
OPTIMAL INCOMPLETE BLOCK DESIGNS
T. J. Mitchell and J. A. John (Southampton Univ.) Jun. 1976 33 p refs
(Contract W-7405-eng-26)
(ORNL-CSD-8) Avail: NTIS HC A03/MF A01

A classical problem in experimental design is the construction of incomplete block designs, i.e., designs that group r replications of each of v treatments into b blocks of size k. This report presents optimal incomplete block designs which were constructed utilizing the connection between the concurrence matrix of a design and a regular graph. The class of regular graph (RG) designs, conjectured to be optimal, is defined. The results of a systematic search of the class or RG designs are given for all cases in which v is less than or equal to 12 and r is less than or equal to 10. In nearly every case, the optimum design with respect to each of the three criteria, D-optimality, A-optimality (identical with) = efficiency and E-optimality, is determined.ERA

N77-18816# Los Alamos Scientific Lab., N.Mex.
ITERATION OF THE NUMBER-THEORETIC FUNCTION f(2n) = n, f(2n + 1) = 3n + 2
C. J. Everett Jul. 1976 7 p
(Contract W-7405-eng-36)
(LA-6449-MS) Avail: NTIS HC A02/MF A01

It is a long-standing conjecture that, under iteration of the number-theoretic function f(2n) = n, f(2n + 1) = 3n + 2, every integer m has an iterate f/sup k/(m) = 1. Since virtually nothing is known about the question, save that it seems to be true for m up to the millions, it may be of interest to know that almost every m has an iterate f/sup k/(m) less than m, a result proved in this report. ERA

N77-18817# Northwestern Univ., Evanston, Ill. Dept. of Computer Sciences.
APPLICATION OF RELAXATION TECHNIQUES TO THE FACTORIZATION OF ITERATIVE PROCEDURES Progress Report
Robert Beauwens May 1976 51 p refs
(Contract E(11-1)-2280)
(COO-2280-12) Avail: NTIS HC A04/MF A01

Relaxation techniques which have been used in connection with the factorization iterative methods are reviewed. Known properties are summarized, and new ones are obtained. A precise meaning is given to the notion of iterative procedures and the two-parameters overrelaxation technique of Woznicki is shown to be a factorization iterative method of the second order; some consequences of this fact are developed. Other results include the refinement of known properties of the extrapolation principle and estimations of the powers of the Oliphant relaxation technique for consistently ordered matrices and of the Chebyshev technique for Stieltjes. ERA

N77-18818# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
STUDIES OF THE NUMERICAL SOLUTION OF ELLIPTIC PARABOLIC BOUNDARY VALUE PROBLEMS
Ivo Babuska 1976 6 p refs
(Contract AT(40-1)-3443)
(ORO-3443-60) Avail: NTIS HC A02/MF A01

A nontechnical summary is given of: (1) the self-adaptive approach in the finite element method and related topics; (2) problems arising from composite materials (homogenization); and (3) the finite element approach to boundary-value problems of mixed type and related topics. ERA

N77-18819# Addis Translations International, Portola Valley, Calif.
METHOD OF FINITE DIFFERENCES AS APPLIED TO PARABOLIC DIFFERENTIAL EQUATIONS
J. Albrecht Jun. 1976 25 p refs Transl. into ENGLISH from Z. fuer Angew. Math. und Mech., (West Ger.), v. 37, no. 5/6, 1957 p 202-212
(Contract W-7405-eng-48)
(UCRL-Trans-11097) Avail: NTIS HC A02/MF A01

The finite difference method as applied to differential equations (heat conduction and bar vibration equations) is discussed. The following aspects are examined: (1) the relationship between stability; (2) step size in time-direction, and position of the lattice points employed; (3) accuracy (mehrstellen method); (4) curved boundaries; and (5) the Runge-Kutta principle. ERA

N77-18820# Royal Aircraft Establishment, Farnborough (England).
GENERALIZED GAUSS QUADRATURE FORMULAE
J. G. Ballantyne Feb. 1976 12 p refs
(RAE-TR-76019; BR52039) Avail: NTIS HC A02/MF A01

The n point Gauss quadrature formula is generalized to cover weighted integrals of the form integral from x sub zero to x sub 1 of w(x)y(x)dx where y(x) is of the form f(x)p(x) and where w(x) and f(x) may be fixed functions of any form and p(x) is a polynomial of degree not greater than 2n - 1. Computer programs for generating the coefficients of the integration formulae for any given f(x) and w(x) are outlined, methods of handling point constraints and cases of failure are discussed, and some applications of the method briefly mentioned. Author (ESA)

N77-18821# Wisconsin Univ., Madison. Mathematics Research Center.
A BIFURCATION THEOREM FOR POTENTIAL OPERATORS
Paul H. Rabinowitz Jun. 1976 28 p refs
(Contracts DAAG29-75-C-0024; N00014-76-C-0300)
(AD-A029943; MRC-TSR-1639) Avail: NTIS HC A03/MF A01 CSCL 12/1

A general bifurcation theorem for potential operators is proved. It describes the possible behavior of the set of solutions of an operator equation as a function of the eigenvalue parameter in a neighborhood of the bifurcation point. The theorem applies in particular to buckling problems in elasticity theory as well as to other fields in which the bifurcation problems have a variational formulation. Author (GRA)

N77-18822# Pennsylvania State Univ., University Park. College of Business Administration.
APPROXIMATIONS OF TWO-ATTRIBUTE UTILITY FUNCTIONS Interim Report
Peter C. Fishburn Sep. 1976 61 p refs
(Contract N00014-75-C-0857; NR Proj. 047-112)
(AD-A029655; TR-20) Avail: NTIS HC A04/MF A01 CSCL 12/1

An assessment is presented of von Neumann-Morgenstern utility functions u defined on two attributes from the viewpoint of mathematical approximation. The method used does not rely on independence axioms that enable u(x, y,) to be expressed in simplified forms when they are valid. GRA

N77-18823# Maryland Univ. Baltimore County, Baltimore. Div. of Mathematics and Physics.
EXPONENTIAL FOURIER DENSITIES ON S2 AND OPTIMAL ESTIMATION AND DETECTION FOR DIRECTIONAL PROCESSES Interim Report
James Ting-Ho Lo and Linda R. Eshleman Jul. 1976 56 p refs
(Grant AF-AFOSR-2671-74; AF Proj. 9769)
(AD-A029556; MPR-RR-76-8; AFOSR-76-1031TR) Avail: NTIS HC A04/MF A01 CSCL 12/1

Two classes of probability densities, the exponential Fourier densities and the exponential trigonometric densities, are

introduced on S2 as well as four kinds of displacements. In general, neither class is closed under the operation of taking conditional distributions with respect to any of the displacements. A combined usage of both classes is required to study the estimation and detection models obtained from various combinations of the displacements. The merits and disadvantages of each model are discussed. Recursive formulas for the conditional densities and the likelihood ratios are derived for many of the models. The additive measurement noise case is also considered in detail. An error criterion for direction estimation is presented with respect to which the optimal estimates can be easily computed from the probability distribution. A deficiency of the models and techniques developed in this paper is that random driving terms are disallowed in the signal processes. How to remove this deficiency remains an open problem. Author (GRA)

N77-18824# Yale Univ., New Haven, Conn. Dept. of Statistics.

INFERENCE OF LATENT ROOTS USING ASYMPTOTIC EXPANSIONS OF LIKELIHOOD FUNCTIONS Final Report, 1 Jul. 1975 - 30 Jun. 1976

Robb J. Muirhead 1976 21 p refs

(Grant AF-AFOSR-2882-75; AF Proj. 9769)

(AD-A029554; AFOSR-76-1029TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The most commonly used multivariate techniques include principal component analysis, factor analysis, canonical correlation analysis, multivariate analysis of variance and discriminant analysis. All of these techniques involve the latent roots and vectors of random matrices, and it is important to be able to make inferences about the population parameters, or a subset of them. Unfortunately, even under the usual assumption that the observations have been drawn from a multivariate normal population, the exact sampling distributions of these random roots and vectors are generally extremely complicated, and it appears difficult, if not impossible, to use them (or the corresponding likelihood functions) directly for inferential purposes. There are two reasons; firstly, the distributions are complicated and very difficult to evaluate numerically (and, as a consequence, the likelihood functions are intractable), and secondly, it is not at all obvious how one should draw inferences about, for example, a few parameters in the presence of many nuisance parameters. This report is concerned with problems such as these in connection with the latent roots occurring in the following three multivariate situations based on normal populations: (1) Principal component analysis; (2) Multivariate analysis of variance and discriminant analysis; and (3) Canonical correlation analysis. GRA

N77-18825# Maryland Univ., College Park. Dept. of Computer Science.

PERTURBATION THEORY FOR THE DEFINITE GENERALIZED EIGENVALUE PROBLEM

G. W. Stewart Sep. 1976 16 p refs

(Contract N00014-76-C-0391)

(AD-A030366; TR-479) Avail: NTIS HC A02/MF A01 CSCL 12/1

Perturbation theory is used for the generalized eigenvalue problem AX = lambda Bx where A and B are real symmetric matrices of order n is greater than or equal to 3. When B is positive definite, as is usually the case in applications, the problem can be reduced to a symmetric eigenvalue problem for the matrix square root of B times the square root of AB, and the wealth of perturbation theory for symmetric eigenvalue problems can be applied. GRA

N77-18826# Ohio State Univ., Columbus. Dept. of Geodetic Science.

COVARIANCE FUNCTIONS IN LEAST-SQUARES COLLOCATION

Helmut Moritz Hanscom AFB, Mass. AFGL Jun. 1976 85 p refs

(Contract F19628-76-C-0010; AF Proj. 7600; OSURF Proj. 4218-A1)

(AD-A030302; DGS-240; AFGL-TR-76-0165; SR-3) Avail: NTIS HC A05/MF A01 CSCL 12/1

The report consists of two parts. Part A deals with the mathematical structure of covariance functions. The properties of isotrophy, harmonicity and positive definiteness are discussed, and it is suggested that a covariance function may be characterized by three essential parameters: the variance, the correlation length and a curvature parameter. Finally some spatial covariance models (planar and spherical) are considered. Part B treats the influence of covariances on the results of collocation. Formulas are developed for the standard error of collocation results when using non-optimal covariance functions, also for the case of stepwise collocation. Finally the behavior of interpolation errors with and without the additional use of horizontal gradients is studied by means of power series expansions for covariance functions and by means of Gaussian covariance functions. It is seen that non-optimal covariance functions have relatively little influence on the interpolated values but a very strong effect on covariances as calculated using the conventional formulas. Author (GRA)

N77-18827# University of Southern Calif., Los Angeles. Dept. of Psychology.

THE ANALYSIS OF DOMINANCE MATRICES: EXTRACTION OF UNIDIMENSIONAL ORDERS WITHIN A MULTIDIMENSIONAL CONTEXT

Thomas J. Reynolds Jun. 1976 74 p refs

(Contract N00014-75-C-0684; NR Proj. 150-373; RR0420401)

(AD-A029450; TR-3) Avail: NTIS HC A04/MF A01 CSCL 12/1

A method of factor extraction specific to a binary matrix, illustrated here as a person-by-item response matrix, is presented. The extraction procedure, termed ERGO, differs from the more commonly implemented dimensionalizing techniques, factor analysis and multidimensional scaling, by taking into consideration item difficulty. The ERGO procedure uses the calculation of a dominance matrix which, for either persons or items, has the important attribute of allowing directionality to be inferred between relations. GRA

N77-18828# North Carolina Univ., Charlotte. Dept. of Mathematics.

POSITIVE DEPENDENCE OF THE BIVARIATE AND TRIVARIATE, ABSOLUTE NORMAL, t, X2 AND F DISTRIBUTIONS

M. Abdel-hameed and Allan Sampson, (Abbott Labs.) Sep. 1976 17 p refs

(Contracts N00014-76-C-0840; N00014-67-A-0235-0006; Grant AF-AFOSR-2999-76)

(AD-A029509) Avail: NTIS HC A02/MF A01 CSCL 12/1

The bivariate, and trivariate, density of the absolute normal distribution is shown to be totally positive of order 2. These results are then used to show that a generalized bivariate, and trivariate, t, x squared and F distributions are associated. A conjecture of the total positivity of the multivariate absolute normal distribution and association of a multivariate t-distribution is given. GRA

N77-18829# IBM Watson Research Center, Yorktown Heights, N.Y. Thomas J. Watson Research Center.

ON LIAPUNOV STABILITY OF STIFF NON-LINEAR MULTISTEP DIFFERENCE EQUATIONS

W. Linger and F. Odeh 11 Mar. 1976 40 p refs

(Contract F44620-75-C-0058; AF Proj. 9749)

(AD-A029731; RC-5900; AFOSR-76-1023TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

The concepts of G-stability and (G,mu)-stability recently introduced by Dahlquist are useful for discussing Liapunov stability of solutions to systems of non-linear difference equations, generated by applying linear multistep formulas to monotone, dissipative, arbitrarily stiff systems of non-linear differential equations. In this paper, the theory of G-stability and (G,mu)-stability is reviewed and a construction is proposed which facilitates the finding of a quadratic Liapunov function. By this construction it is proved that, for the four-parameter family of all three-step formulas which are second-order accurate, A-stability is necessary and sufficient for G-stability. Some results on (G,mu)-stability are also obtained by this construction. GRA

N77-18830# IBM Watson Research Center, Yorktown Heights, N.Y. Thomas J. Watson Research Center.

ON STABILITY AND ACCURACY OF NUMERICAL INTEGRATION METHODS FOR STIFF DIFFERENTIAL EQUATIONS
W. Linger 6 May 1976 23 p refs
(Contract F44620-75-C-0058)
(AD-A029728; RC-5976; AFOSR-76-1022TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper surveys research concerning the stability and accuracy of numerical integration methods for stiff systems of ordinary differential equations. First, the theory of A-stability of linear multistep methods is reviewed. Second, weaker concepts of unconditional fixed-h stability are discussed. Third, examples of A-stable methods of high orders of accuracy are given. Fourth, results relating the order of accuracy to various stability concepts are listed. Fifth, some recent work concerning asymptotic stability of non-linear multistep difference equations is summarized. GRA

N77-18831# Colorado State Univ., Fort Collins. Dept. of Mathematics.
PERIODIC QUADRATIC SPLINE INTERPOLANT OF MINIMAL NORM Interim Report
Guenter Meinardus and G. D. Taylor 1976 8 p refs
(Grant AF-AFOSR-2878-76; AF Proj. 9749)
(AD-A029552; AFOSR-76-0996TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

It is shown that the periodic quadratic spline interpolant has minimal norm if the knots are equally spaced. Author (GRA)

N77-18832# Maryland Univ., College Park. Dept. of Computer Science.
ON THE HOUSEHOLDER-FOX ALGORITHM FOR DECOMPOSING A PROJECTION
G. W. Stewart and Cleve B. Moler Sep. 1976 20 p refs
(Contract N00014-76-C-0391)
(AD-A030973; TR-483) Avail: NTIS HC A02/MF A01 CSCL 12/1

The Householder-Fox algorithm uses the Cholesky decomposition to calculate an orthonormal basis for the range of a projection. In this paper it is shown that the algorithm continues to give good results when it is applied to an approximate projection in the presence of rounding error. Author (GRA)

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N77-18833# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
CONFIDENCE LIMITS FOR PARAMETERS OF POISSON AND BINOMIAL DISTRIBUTIONS
L. M. Arnett Apr. 1976 20 p refs
(Contract AT(07-2)-1)
(DP-1416) Avail: NTIS HC A02/MF A01

The confidence limits for the frequency in a Poisson process and for the proportion of successes in a binomial process were calculated and tabulated for the situations in which the observed values of the frequency or proportion and an a priori distribution of these parameters are available. Methods are used that produce limits with exactly the stated confidence levels. The confidence interval [a,b] is calculated so that Pr [a less than or equal to lambda less than or equal to b c,mu], where c is the observed value of the parameter, and mu is the a priori hypothesis of the distribution of this parameter. A Bayesian type analysis is used. The intervals calculated are narrower and appreciably different from results, known to be conservative, that are often used in problems of this type. A Monte Carlo experiment was conducted to verify a selected interval from those calculated. This numerical experiment confirmed the results of the analytical methods and the prediction of Pearson and Hartley that their published tables give conservative results. ERA

N77-18834# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Statistics.
A DIFFUSION APPROXIMATION ANALYSIS OF A GENERAL n-COMPARTMENT SYSTEM Interim Report
John P. Lehoczky and Donald P. Gaver (Naval Postgraduate School) Jun. 1976 32 p refs
(Grants AF-AFOSR-2642-74; NSF AG-467; AF Proj. 9769)
(AD-A029558; TR-110; AFOSR-76-1058TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

A new approach to the stochastic analysis of general compartment models is presented. The analysis is based on the concept of diffusion approximations. The state of a compartment system is represented as the superposition of a deterministic process, characterized by a system of ordinary differential equations, and a random noise process characterized by stochastic differential equations. All transition rate parameters are permitted to be time dependent. Numerical solutions are presented for the two-compartment case, and compared with those of Cardenas and Matis (1975a). Extensions to non-linear compartment models are discussed. Author (GRA)

N77-18835# North Carolina Univ., Chapel Hill. Dept. of Statistics.
A SURVEY OF SEQUENTIAL APPROACHES TO THE PROBLEM OF SELECTING THE BEST OF K POPULATIONS Interim Report
William L. Lane Jul. 1976 46 p refs
(Grant AF-AFOSR-2796-75; AF Proj. 9769)
(AD-A029555; MIMEO-SER-1079; AFOSR-76-1030TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

The current literature on sequential ranking and selection procedures is surveyed. Special emphasis is placed on unpublished results concerning procedures which eliminate inferior populations early in the experiment. Author (GRA)

N77-18836# Center for Naval Analyses, Arlington, Va.
EXPERIMENTAL VALIDATION OF PROBABILITY PREDICTIONS
Richard D. Haskell Aug. 1976 35 p refs
(AD-A030458; CNA-Professional Paper-158) Avail: NTIS HC A03/MF A01 CSCL 12/2

A common type of simulation used in military operations research estimates the probability of a particular occurrence, such as detection of a submarine. Because of the constraints on operational exercises which examine these events, there is seldom sufficient replication for traditional validation. The purpose of this paper is to derive the methodology for using classical test statistics in the validation of these simulation models, using a small, varied data base. Two specific types of experiments are considered: Bernoulli trials and truncated Bernoulli trials. For each type of experiment, tests are suggested which examine overall bias of predicted probabilities, the variance of the experimental sequence, correlation of the predicted probabilities with observed successes, and, where adequate data is available, agreement over the range of probability predictions.
Author (GRA)

N77-18837# North Carolina Univ., Chapel Hill.
SOME TEST RESULTS ON THE SIMSCRIPT II.5 AND SIMPL/1 PSEUDORANDOM NUMBER GENERATORS
George S. Fishman Jul. 1976 21 p refs
(Contract N00014-76-C-0302)
(AD-A030276; TR-76-11) Avail: NTIS HC A02/MF A01

This paper presents results of applying the runs up and down test, the chi-square goodness-of-fit test and the serial test to streams of pseudorandom numbers generated by the pseudorandom number generators implemented in the IBM version of SIMSCRIPT II.5, in SIMPL/1 and using their default seeds. Although this limited testing prevents general conclusions, the results presented here do identify several areas of concern. GRA

N77-18838# Federal Electric Corp., Vandenberg AFB, Calif.
APPLICATIONS OF VARIANCE FACTORS IN EVALUATIONS OF TRAJECTORY SOLUTION ACCURACIES Final Report
Russell E. Roy 9 Jan. 1976 15 p refs
(Contract F04701-72-C-0203)
(AD-A030279; SAMTEC-TR-76-198) Avail: NTIS HC A02/MF A01 CSCL 12/1

This report presents an expository description of certain statistics, called 'variance factors' herein. These statistics play a dominant role whenever accuracies of trajectory coordinate

solutions are evaluated since they effectively scale the standard deviations and covariances of the coordinate solutions. Conventionally, standard deviations (often called 'GDOPs' or 'uncertainties' in range parlance) are used to evaluate solution accuracies so that 'variance factors' should be acknowledged whenever uncertainties are calculated. This is not always the case, sometimes 'variance factors' are implicitly neglected. For example, the program called NITE that is currently used by SAMTEC to determine trajectory solutions and uncertainties has no capability to calculate variance factors; consequently, uncertainties of trajectory solutions calculated by NITE may not be appropriately scaled (i.e., compared to unity). GRA

N77-18839# Pennsylvania State Univ., University Park.
CONTINUA OF STOCHASTIC DOMINANCE RELATIONS FOR BOUNDED PROBABILITY DISTRIBUTIONS Interim Report
Peter C. Fishburn Sep. 1976 35 p refs
(Contract N00014-75-C-0957; NE Proj. 047-112)
(AD-A029656; TR-21) Avail: NTIS HC A03/MF A01 CSCL 12/1

Notions of first degree and second degree stochastic dominance in decision making under risk have been developed and used for more than a decade. This report extends these notions to Alpha-degree stochastic dominance for every real number Alpha equal to or greater than unity. The extensions are accomplished using a standard version of fractional integral, and classes of utility functions that are congruent with the stochastic dominance relations are identified. Author (GRA)

N77-18840# Northwestern Univ., Evanston, Ill. Dept. of Industrial Engineering and Management Sciences.
CONTRIBUTIONS TO THE THEORY OF MASS SCREENING
John A. Voelker Jun. 1976 119 p refs
(Contracts N00014-67-A-0356-0030; N00014-75-C-0797; NR Proj. 042-322)
(AD-A029442; TR-2) Avail: NTIS HC A06/MF A01 CSCL 12/1

Consider a population (composed, for example, of people, machines, or livestock) subject to a randomly occurring defect or disease. If there exist testing procedures capable of detecting the defect before it would otherwise become known, and if such early detection provides benefit, the periodic administration of such a test procedure to the members of the population, i.e., a mass screening program, may be advisable. This thesis develops and analyzes two analytical models of a mass screening program. In both models, the defect arrival process is Poisson and the ability of the test to recognize a defect is not, in general, assumed perfect. The first model represents the evolution of the defect, once it occurs, as a semi-Markov process. Both the test reliability and the detection payoff are dependent upon the state of that process. The second model is structurally simpler, focusing on the time since incidence of a defect as the factor which determines the relability of a test administration and the value of a detection. GRA

N77-18841# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Statistics.
BAYESIAN ANALYSIS OF THE LINEAR MODEL SUBJECT TO LINEAR INEQUALITY CONSTRAINTS
William W. Davis Aug. 1976 31 p refs
(Contract N00014-76-C-0930; NR Proj. 042-367)
(AD-A031117; TR-118) Avail: NTIS HC A03/MF A01 CSCL 12/2

This paper considers the general linear model when the parameter space is subject to linear inequalities. Four examples satisfying the assumptions are given. A Bayesian Analysis of this model is presented using a natural conjugate prior density of the mixed type. An analysis is given for the case that prior information about the parameters is vague. The Bayesian and sampling methods of model selection are compared in the case when little is known a priori. Author (GRA)

N77-18842# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
SOME MULTIPLE DECISION PROBLEMS IN ANALYSIS OF VARIANCE
Shanti S. Gupta and Deng-Yuan Huang (Academia Sinica) Jul. 1976 24 p refs
(Contracts N00014-67-A-0226-0014; N00014-75-C-0455; NR Proj. 042-243)
(AD-A030869; Mimeo-Ser-458) Avail: NTIS HC A02/MF A01 CSCL 12/2

In most practical situations to which the analysis of variance tests are applied, they do not supply the information that the experimenter aims at. If, for example, in one-way ANOVA the hypothesis is rejected in actual application of the F-test, the resulting conclusion that the true means theta sub 7, ...,theta sub K are not all equal, would by itself usually be insufficient to satisfy the experimenter. In fact his problems would begin at this stage. The experimenter may desire to select the best population or a subset of the good populations; he may like to rank the populations in order of goodness or he may like to draw some other inferences about the parameters of interest. The extensive literature on selection and ranking procedures depends heavily on the use of independence between populations (block, treatments, etc.) in the analysis of variance. In the present paper, a method was derived to construct locally best (in some sense) selection procedures to select a non empty subset of the k populations containing the best population as ranked in terms of theta sub 1's which control the size of the selected subset and which maximizes the probability of selecting the best. Also considered was the usual selection procedures in one-way ANOVA based on the generalized least squares estimates and apply the method to two-way layout case. GRA

N77-18843# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
ON SOME METHODS FOR CONSTRUCTING OPTIMAL SUBSET SELECTION PROCEDURES
Shanti S. Gupta and D. Y. Huang (Academia Sinica) Sep. 1976 11 p refs
(Contract N00014-75-C-0455; NR Proj. 042-243)
(AD-A030866; Mimeo-Ser-470) Avail: NTIS HC A02/MF A01 CSCL 12/2

In this paper, we are concerned with the construction of 'optimal' subset selection procedures. Some classical selection procedures are considered as special cases. Author (GRA)

N77-18844# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
ON SOME MULTIPLE DECISION PROBLEMS
Ming-Wei Lu Aug. 1976 123 p refs
(Contract N00014-67-A-0226-0014; NR Proj. 042-243)
(AD-A030868; Mimeo-Ser-464) Avail: NTIS HC A06/MF A01 CSCL 12/1

This thesis deals with some selection and ranking procedures for restricted families of probability distributions. A selection rule is proposed for distributions which are convex-ordered with respect to a specified distribution G. Some properties of this selection rule are derived. The asymptotic relative efficiencies of this rule with respect to other selection rules are evaluated. A selection rule is also proposed and studied for distributions which are s-ordered with respect to G. Some interval estimation problems for the unknown parameters of the k populations are studied. The infimum of the probability that a given confidence interval (based on suitably chosen order statistics) contains at least one good population is obtained. Different modifications and variations of this problem are also studied. The selection procedures are discussed in terms of majorization and weak majorization. The parameter is partially ordered by means of majorization or weak majorization. A class of procedures R sub h for selecting the best population is defined. GRA

N77-18845# Cornell Univ., Ithaca, N.Y. Dept. of Operations Research.
THE EMPIRICAL DISTRIBUTION FUNCTION WITH ARBITRARILY GROUPED, CENSORED, AND TRUNCATED DATA
Bruce W. Turnbull Jul. 1976 34 p refs
(Contract DAHC04-73-C-0008; N00014-75-C-0586)
(AD-A030940; TR-305) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper is concerned with the nonparametric estimation of a distribution function F, when the data are incomplete due

to grouping, censoring and/or truncation. The situation occurs frequently in survivorship, reliability, and recidivism analysis. Using the idea of self-consistency, a simple algorithm is constructed and shown to converge monotonically to yield a maximum likelihood estimate of F. The procedure compares favorably with the more cumbersome Newton-Raphson method. A test is proposed for comparing two distributions when data on one or both is incomplete and some other applications of the empirical distribution function are indicated. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N77-18846# California Univ., Los Angeles. Western Management Science Inst.
THE PURPOSE OF MATHEMATICAL PROGRAMMING IS INSIGHT, NOT NUMBERS
Arthur M. Geoffrion Jun. 1976 25 p refs Sponsored in part by NSF
(Contract N00014-75-C-0570)
(AD-A030006; WMSI-WP-249) Avail: NTIS HC A02/MF A01 CSCL 12/2

The ostensible purpose of a mathematical programming model is to optimize a stipulated objective function subject to stipulated constraints. But its true purpose, at least in strategic applications as every experienced practitioner should know, is to help develop insights into system behavior which in turn can be used to guide the development of effective plans and decisions. Such insights are seldom evident from the output of an optimization run. One must know not only what the optimal solution is for a given set of input data, but also why. This paper advocates the use of highly simplified analytic models to help explain the whys behind the solutions of conventional mathematical programming models. This approach is illustrated with reference to a facility location study carried out recently for a consumer products manufacturer. GRA

N77-18847# Stanford Univ., Calif. Dept. of Operations Research.
ON FUNCTIONS WHOSE STATIONARY POINTS ARE GLOBAL MINIMA
Israel Zang, Eng Ung Choo, and Mordecai Avriel Jul. 1976 22 p refs Revised
(Contracts N00014-75-C-0267; E(04-3)-326; NR Proj. 047-064)
(AD-A030691; SU-TR-76-13-Rev) Avail: NTIS HC A02/MF A01 CSCL 12/2

In this paper a characterization of functions whose stationary points are global minima is studied. By considering the level sets of a real function as a point-to-set mapping, and by examining its semi-continuity properties, we obtain a result that a real function, defined on a subset of Rn and satisfying some mild regularity conditions, belongs to the above family if and only if the point-to-set mapping of its level sets is strictly lower semicontinuous. Mathematical programming applications are also mentioned. Author (GRA)

N77-18848# Stanford Univ., Calif. Dept. of Operations Research.
A HOMOTOPY BASED APPROACH TO UNCONSTRAINED OPTIMIZATION
Mordecai Avriel and Jerald P. Dauer Jul. 1976 31 p refs
(Contract N00014-75-C-0267; Grant NSF MPS-71-03341; NR Proj. 047-064)
(AD-A030677; SU-TR-76-14) Avail: NTIS HC A03/MF A01 CSCL 12/2

The problem of finding a local minimum of a real differentiable function is considered from a homotopic point of view. Using the Davidenko embedding method with a particular homotopy, an ordinary differential equation is derived. Solution of this equation by Euler's rule gives rise to an iteration formula for the optimization problem. Convergence and termination properties of this formula are discussed. Author (GRA)

N77-18849# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
DISTRIBUTIONS OF CHARACTERISTIC ROOTS IN MULTIVARIATE ANALYSIS
K. C. S. Pillai Jul. 1976 69 p refs Submitted for publication
(Contract N00014-75-C-0455; NR Proj. 042-243)
(AD-A030867; Mimeo-Ser-462) Avail: NTIS HC A04/MF A01 CSCL 12/2

A review of the work on distributions of characteristic (ch.) roots in real Gaussian multivariate analysis has been attempted surveying the developments in the field from the start covering about fifty years. The exact null and non-null distributions of the ch. roots have been reviewed and sub-asymptotic and asymptotic expansions of the distributions mostly for large sample sizes studied by various authors, have been briefly discussed. Such distributional studies of four test criteria and a few less important ones which are functions of ch. roots have further been discussed in view of the power comparison made in connection with tests of three multivariate hypotheses. In addition, one-sample case has also been considered in terms of distributional aspects of the ch. roots and criteria for tests of two hypotheses on the covariance matrix. A brief critical review has also been attempted. For convenience in organization, the review has been given in two parts: Part I. Null distributions and Part II. Non-null distributions. Author (GRA)

N77-18850# Michigan Univ., Ann Arbor. Dept. of Industrial and Operations Engineering.
SOME PROPERTIES OF SEMI-MARKOV SWITCHES
Donald C. McNickel Aug. 1976 14 p refs
(Contract N00014-75-C-0492)
(AD-A030899; TR-76-3) Avail: NTIS HC A02/MF A01 CSCL 12/2

This paper considers some properties of a broad class of network decomposition switches. Expression are given for the semi-Markov matrices of the output Markov renewal processes they produce, and a classification theorem for the states in these processes. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N77-18851*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECT OF COEFFICIENT CHANGES ON STABILITY OF LINEAR RETARDED SYSTEMS WITH CONSTANT TIME DELAYS
L. Keith Barker Washington Mar. 1977 14 p refs
(NASA-TN-D-8412; L-11298) Avail: NTIS HC A02/MF A01 CSCL 12B

A method is developed to determine the effect of coefficient changes on the stability of a retarded system with constant time delays. The method, which uses the tau-decomposition method of stability analysis, is demonstrated by an example. Author

N77-18852# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
ON SUBSET SELECTION PROCEDURES FOR POISSON PROCESSES AND SOME APPLICATIONS TO THE BINOMIAL AND MULTINOMIAL PROBLEMS
Shanti S. Gupta and Wing-Yue Wong Jul. 1976 39 p refs
(Contract N00014-75-C-0455; NR Proj. 042-243)
(AD-A030865; Mimeo-Ser-457) Avail: NTIS HC A03/MF A02 CSCL 12/1

The Poisson process arises in many applications, especially, as a model for arrivals at a store, for arrivals of calls at a telephone exchange, for arrivals of radioactive particles at a Geiger counter, etc. In this paper, the problem of selecting a subset of k different Poisson processes including the best which is associated with the largest value of the mean rate is discussed. Some subset selection procedures are proposed and studied. An application of these procedures to the subset selection problem for the largest probability of a success of k binomial populations, whose parameters are unknown, is considered. Results are also

applied to the problem of selecting the largest cell probability from a multinomial distribution, again the cell probabilities being unknown. GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N77-18853 Polish Academy of Sciences, Warsaw. Inst. of Fundamental Technological Research.
ARCHIVES OF MECHANICS, VOLUME 28, ISSUE 3
1976 203 p refs Presented at Symp. on Continuum Models of Discrete Systems, Jodlowy Dwor, Poland, Jun. 1975
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A symposium was held on a wide range of subjects treating in various ways and by various means the relation between discrete and continuous systems. Material on composites was presented from an engineering point of view. General continuum theories were discussed and applied to particular materials. Other areas included local and non-local properties of crystals, and the relations between variance of various models. A phonon description of thermomechanics, both classical and quantum, was also included. For individual titles, see N77-18854 through N77-18876.

N77-18854# Northwestern Univ., Evanston, Ill.
GENERALIZED CONTINUUM THEORIES FOR DIRECTIONALLY REINFORCED SOLIDS **c39**
J. D. Achenbach *In* Polish Acad. Sci. Arch. Mech. 1976 p 257-278 refs (For primary document see N77-18853 09-70) (Contract N00014-67-A-0356-0034)
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A theory of elasticity with microstructure for fiber reinforced composites with a rectangular array of the fibers is outlined. The theory is based on expansions of the displacements across representative cells. The transition from the actually inhomogeneous composite to a homogeneous continuum is achieved by introducing continuous fields for gross displacements and local deformations. The elastic constants are expressed explicitly in terms of the constants defining the mechanical behavior of the fibers and the matrix material, and the parameters describing the geometrical layout of the composite. A number of specific examples involving the dispersive behavior of time-harmonic waves propagating in directions parallel and normal to the fibers are discussed. These cases are relevant to available data of ultrasonic tests on composite materials. Analytical results are compared with test data, and with some results obtained by the finite element technique. Author

N77-18855# Technische Hogeschool, Eindhoven (Netherlands).
A NOTE ON THE PHYSICAL FOUNDATION OF THE THEORY OF MULTIPOLE-STRESSES **c39**
J. B. Alblas *In* Polish Acad. Sci. Arch. Mech. 1976 p 279-298 refs (For primary document see N77-18853 09-70)
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Balance equations for linear momentum, angular momentum and energy are derived for the model of a body, consisting of a very large number of molecules, each composed of a number of subparticles. The method for deriving the equations is based on classical statistical mechanics (ensemble theory). Many aspects of the phenomenological theories of micropolar elasticity are confirmed. It appears that the inclusion of ever higher derivatives of the strain gradient in continuum mechanics is set bound to, by the existence of stress fluctuations. It is believed that a generalization of the molecular theory on quantum mechanical basis is possible. The theory is also be applied to the consideration of a continuous body, composed of a large number of very small grains. The conditions for the possibility of application is ensured if statistical methods are used. Author

N77-18856# McGill Univ., Montreal (Quebec). Micromechanics of Solids Lab.
MICROMECHANICS OF DISCRETE SYSTEMS **c39**
D. R. Axelrad *In* Polish Acad. Sci. Arch. Mech. 1976 p 299-315 refs (For primary document see N77-18853 09-70)
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A general theory of stochastic deformations of discrete media is developed. Mathematical theory of probability and functional analysis are used in the representation of the deformational behavior of discrete systems. An operator formalism is also employed in order to represent the material characteristics during the steady state and transient behavior of the material. Author

N77-18857# Colorado Univ., Boulder. Dept. of Mechanical Engineering.
SCATTERING OF ELASTIC WAVES BY A DISTRIBUTION OF INCLUSIONS **c39**
S. K. Datta *In* Polish Acad. Sci. Arch. Mech. 1976 p 317-324 refs (For primary document see N77-18853 09-70)
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The propagation of a plane P-wave in the presence of a distribution of spheroidal shaped rigid inclusions embedded in a homogeneous isotropic elastic medium is studied. It is assumed that the inclusions are identical in properties and are homogeneously and at random distributed with their symmetry axes parallel to one another. Expressions for the propagation constant alpha for propagation along and perpendicular to the axis of symmetry are obtained with an accuracy to O(c), c being the concentration (small). Author

N77-18858# Technische Hochschule, Dresden (East Germany). Dept. of Physics.
DERIVATION OF A GENERALIZED CONTINUUM THEORY FOR HETEROGENEOUS MATERIALS **c76**
G. Diener, Ch. Raabe, and H.-G. Schoepf *In* Polish Acad. Sci. Arch. Mech. 1976 p 325-332 refs (For primary document see N77-18853 09-70)
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A macroscopic continuum theory is derived starting from the microstructure of a heterogeneous (composite) material by means of ensemble averaging. Besides the mean field, it contains additional degrees of freedom, called multipole fields. It is shown that as a matter of principle, a local theory of that kind, described by differential equations, cannot be acheived up to an arbitrarily high accuracy, but is restricted to the long wave range. Author

N77-18859# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
KINETIC THEORY OF HYDRODYNAMIC FLOW **c34**
J. R. Dorfman, H. VanBeijeren, and C. F. McClure *In* Polish Acad. Sci. Arch. Mech. 1976 p 333-352 refs Sponsored in part by Navy (For primary document see N77-18853 09-70) (Grant NSF GP-38965)
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A dilute monatomic gas flowing around a macroscopic heavy object is considered. An extended Boltzmann equation for the gas presence of the object is derived, and it is shown that the extended Boltzmann equation is equivalent to the usual Boltzmann equation supplemented by the boundary conditions imposed on the distribution function at the surface of the object. The equation is then solved in two ways. When the mean free path of a gas molecule is small compared to the characteristic size of the object, normal solutions of the Boltzmann equation are derived. When the mean free path is large compared to the size of the object, the Boltzmann equation is solved by an iteration method which describes the flow of a rarefied gas about the object. Author

N77-18860# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.
THEORIES WITH CARRIER FIELDS: MULTIPLE-INTERACTION NONLOCAL FORMULATIONS **c76**
D. G. B. Edelen *In* Polish Acad. Sci. Arch. Mech. 1976 p 353-368 refs (For primary document see N77-18853 09-70)
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A finite number of functions of position and time called carrier fields, that describe the microscopic properties of the body and are such that appropriately defined operators on the carriers describe the marcoscopic properties of the body, are examined. Two classes of problems are solved. The first class consists of a homogeneous variational principle for the carriers whose Lagrangian function contains bounded linear operators acting on the carriers. The second class replaces the homogeneous

variational principle by an inhomogeneous one, and the Lagrangian function is allowed to depend on nonlinear operators appropriate to the representation of multiple interactions. The results allow the derivation and generalization of the governing equations for theories reported under the general headings of multipolar, micropolar, simple, director, and nonlocal field theories. Author

N77-18861# Polish Academy of Sciences, Warsaw. Inst. of Fundamental Technological Research.

PLASTIC STRAINS IN COMPOSITE MEDIA **c39**

Cz. Eimer *In its* Arch. Mech. 1976 p 369-384 refs (For primary document see N77-18853 09-70)

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Constitutive equations (in a frame of infinitesimal theory) for a random multiphase medium, each of the phases being assumed to be perfectly elastic-plastic, are derived. The fields of stress and strains caused by distortions (in a probabilistic description) are determined, and the distortion field is found on the basis of the energetic theorems of plasticity theory. The parametric representation of the stress-strain curves is obtained in which the solution for a perfectly elastic reference medium is a parameter. The effects of macrononhomogeneity and plastic nonlocality are analyzed. Author

N77-18862# Geneva Univ. (Switzerland).

COUPLED HYDRODYNAMIC MODES NEAR STRUCTURAL PHASE TRANSITIONS IN CRYSTALS **c76**

C. P. Enz *In* Polish Acad. Sci. Arch. Mech. 1976 p 384-392 refs (For primary document see N77-18853 09-70)

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The thermo-elastic description of a crystal is discussed and applied in the vicinity of a structural phase transition of the displacive type. The associated soft phonon mode causes a strong temperature dependence of certain elastic parameters which gives rise to a coupling between the elastic and the thermal variables. The coupling is responsible for a central peak in the elastic response and may explain recent neutron scattering data of SrTiO3 and Nb3Sn. Author

N77-18863# Stuttgart Univ. (West Germany).

THE NONLOCAL THEORY OF ELASTICITY AND ITS APPLICATION TO INTERACTION OF POINT DEFECTS **c76**

B. K. D. Gairola *In* Polish Acad. Sci. Arch. Mech. 1976 p 393-404 refs (For primary document see N77-18853 09-70)

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The basic mathematical concepts of a nonlocal theory of elasticity are discussed. As a typical example of application of the theory, the interaction between defects which takes place through the displacement fields produced by them when the lattice is allowed to relax is considered. The results obtained by means of the nonlocal theory of elasticity are different from those of the conventional theory. In conclusion, the energy of interaction between two spherically symmetric defects in an isotropic medium does not vanish, as it does according to the conventional theory. Author

N77-18864# Stanford Univ., Calif. Div. of Applied Mechanics.

ON CONTINUUM MODELING OF THE DYNAMIC BEHAVIOR OF LAYERED COMPOSITES **c39**

G. Herrmann, R. K. Kaul, and T. J. Delph *In* Polish Acad. Sci. Arch. Mech. 1976 p 405-421 refs Sponsored in part by NSF (For primary document see N77-18853 09-70)

(Contract N00014-76-C-0054; Grant AF-AFOSR-2669-74)

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A hierarchy of approximate continuum theories to model the dynamic behavior of layered composites, termed matched effective stiffness theories, is advanced. In each approximation the approximate frequency spectra are matched as closely as possible with the exact spectra, and the range of validity of each approximation is ascertained. With the example of SH-waves propagating normal to the layering, it is shown that rather simple approximate field equations are capable of describing accurately the important filtering property of a composite. Similarities to certain phenomena in solid state physics are pointed out, and, finally, an analogy to a system with one degree of freedom is drawn. Author

N77-18865# Cambridge Univ. (England). Dept. of Applied Mathematics and Theoretical Physics.

ON THE AVERAGED-EQUATION APPROACH TO CONDUCTION THROUGH A SUSPENSION **c34**

D. J. Jeffrey *In* Polish Acad. Sci. Arch. Mech. 1976 p 423-429 refs (For primary document see N77-18853 09-70)

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The group expansion for the average heat flux through a suspension using the averaged-equation approach to the problem was derived. The equation governing heat conduction is expressed in a form which reflects the structure of the suspension, and ensemble average is then taken. The resulting hierarchy of equations is solved by truncation, and the familiar group-expansion solution emerges. This shows that the averaged-equation approach is consistent with earlier approaches. Author

N77-18866# Heriott-Watt Univ., Edinburgh (Scotland). Dept. of Mathematics.

CONVERGENCE OF SOLUTIONS OF THE EQUATIONS OF DYNAMIC LINEAR DIPOLAR ELASTICITY TO THE SOLUTIONS OF CLASSICAL ELASTODYNAMICS **c39**

R. J. Knops and B. Straughan *In* Polish Acad. Sci. Arch. Mech. 1976 p 431-441 refs (For primary document see N77-18853 09-70)

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The problem of convergence of solutions of the equations of dynamic linear dipolar elasticity to the solutions of the equations of linear elastodynamics as the dipolar terms tend to zero is presented. For bounded regions, provided the solutions satisfy an a priori bound there is L2-convergence in the sense of Holder. No definiteness assumptions are required on the respective elasticities. For unbounded regions, convergence exists in a specified L2-sense, but now the monopolar elasticities must be positive semi-definite and the dipolar displacement suitably restricted at infinity. Author

N77-18867# Ceskoslovenska Akademie Ved, Prague.

NON-PLANAR DISLOCATION CORES **c76**

F. Kroupa *In* Polish Acad. Sci. Arch. Mech. 1976 p 442-454 refs (For primary document see N77-18853 09-70)

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The models of dislocations in crystals are reviewed from the point of view of continuum models of a discrete lattice. Special attention is paid to the Peierls-Nabarro model, which takes into account the discrete crystal structure along one slip plane. The Peierls-Nabarro model is then generalized to describe a screw dislocation with its core extended along three slip planes. The possibility application of the proposed model in the study of sessile-glissile transformations of screw dislocations in b.c.c. metals under an external stress is finally discussed. Author

N77-18868# Max-Planck-Institut fuer Metallforschung, Stuttgart (West Germany).

ORDERED VERSUS DISORDERED MATERIALS: CONSEQUENCES FOR THE CONTINUUM MODEL **c76**

E. Kroener *In* Polish Acad. Sci. Arch. Mech. 1976 p 455-465 refs (For primary document see N77-18853 09-70)

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The class of solid materials was divided into perfectly ordered, partially disordered and perfectly disordered materials. After discussing the propagation of elastic waves it is found that the frequency spectra of these groups of materials exhibit remarkable differences which are observed in macroscopic experiments. Author

N77-18869# Liege Univ. (Belgium).

PLASTIC DEFORMATION OF FCC POLYCRYSTALS IN THE MICROSTRAIN REGION **c76**

J. Lambermont *In* Polish Acad. Sci. Arch. Mech. 1976 p 257-278 refs (For primary document see N77-18853 09-70)

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The plastic tensile strain in this region was experimentally found related quadratically to the tensile stress and linearly to the grain volume. The general thermodynamic theory of plasticity developed by the author leads to this result. The prevailing equations are also derived along the lines employed by metallurgists. This example provides a bridge to the gap which exists

between the mathematical and physical theories of plasticity. Author

N77-18870# California Inst. of Tech., Pasadena. Chemical Engineering.
THE EFFECTIVE CONDUCTIVITY OF DILUTE SUSPENSIONS c34
L. G. Leal and T. J. McMillen *In* Polish Acad. Sci. Arch. Mech. 1976 p 483-499 refs (For primary document see N77-18853 09-70)
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The effective conductivity is shown to depend not only on the physical properties and concentration of the particles, but also critically on both the type and strength of any bulk flow which is present. Two distinct types of flow effects are distinguished; the flow dependence of the suspension microstructure (i.e., the statistical distributions of orientation and shape for the particles), and the flow dependence of the local temperature distributions at the microscale of the individual particles. Specific calculations are reported for suspensions of spherical drops, slightly deformed drops, and rigid prolate spheroidal particles, all in the limit of small particle Peclet number. In the latter case, the influence of Brownian rotations is included. Author

N77-18871# Muenster Univ. (West Germany).
INVARIANCE CONDITIONS IN THE TRANSMISSION FROM DISCRETE LATTICE MODELS TO THE CONTINUUM LIMIT c76
W. Ludwig *In* Polish Acad. Sci. Arch. Mech. 1976 p 501-515 refs (For primary document see N77-18853 09-70)
Copyright. Avail: Issuing Activity

Certain statements on the macroscopic properties of crystals were derived from invariances against certain symmetry transformations. This was shown for elastic properties and also for the elastic limit of lattice theory in simple cases. A unique and consistent transition from lattice theory including internal degrees of freedom is possible only if the conditions of translational and rotational invariance are satisfied. Author

N77-18872# Polish Academy of Sciences, Warsaw.
ON THE THEORY OF LINEAR ELASTICITY IN STATISTICALLY HOMOGENEOUS MEDIA c39
P. Mazilu *In its* Arch. Mech. 1976 p 517-529 refs (For primary document see N77-18853 09-70)
Copyright. Avail: Issuing Activity

A statistically homogeneous elastic medium subjected to non-uniform strain field was considered; the expression of the effective elastic moduli and the equations for the mean values of stress and strain were derived. Particular attention is paid to the model of perfectly disordered composite materials in order to describe the polycrystalline aggregates having a very fine microstructure. Author

N77-18873# McGill Univ., Montreal (Quebec). Micromechanics of Solids Lab.
THE EFFECTIVE ELASTIC RESPONSE OF RANDOMLY ORIENTED POLYCRYSTALLINE SOLIDS IN TENSION c76
J. W. Provan and D. R. Axelrad *In* Polish Acad. Sci. Arch Mech. 1976 p 531-547 refs (For primary document see N77-18853 09-70)
Copyright. Avail: Issuing Activity

The probabilistic micromechanics theory, albeit in its elastic format, was applied to actual polycrystalline solids in the form of pure copper and aluminum constrained in a simple but realistic boundary value configuration. In doing so, all of the previously introduced experimental material, kinematic and stress concepts of the micromechanics theory pertaining to the elastic deformation of polycrystalline materials, were utilized and, for the first time in most instances, are numerically evaluated for the two materials in question. In particular, the actual numerical determination of microstress distributions in the case of uniaxially stressed specimens has represented one of the primary goals of micromechanics since its inception. Author

N77-18874# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.
THE PASSAGE FROM A PARTICLE SYSTEM TO A CONTINUUM MODEL c76
R. S. Rivlin *In* Polish Acad. Sci. Arch. Mech. 1976 p 549-561 refs Sponsored by NSF (For primary document see N77-18853 09-70)
Copyright. Avail: Issuing Activity

A three dimensional lattice is considered in which each cell contains a number of mass-points. These mass-points undergo displacements under the action of forces. Under appropriate smoothness assumptions regarding the forces and displacements, moving from mass-point to corresponding mass-point in neighboring cells, a continuum model of the director type is formulated for the mechanical behavior of the system. Particular attention is given to the identification of the surface of the system.Author

N77-18875# Polish Academy of Sciences, Warsaw.
QUASICONTINUUM THEORY OF CRYSTALS c76
D. Rogula *In its* Arch. Mech. 1976 p 563-569 refs (For primary document see N77-18853 09-70)
Copyright. Avail: Issuing Activity

The fundamental concepts of the quasicontinuum theory and its applications to crystalline media are examined. Various relevant methods of interpolation are presented and compared, and a definition of the class of QC-functions is given. Some most important properties of the QC-functions are exhibited, and their action in the procedure of passing from a discrete to a continuum model is shown. The notion of equivalence of operators in QC-theory is introduced, and a number of examples of mutual equivalences between differential, integral and discrete operators are given. The relation between quasicontinuum and nonlocal continuum as well as between quasicontinuum and discrete lattice is examined. The concept of differential models of discrete lattices is introduced and discussed. Author

N77-18876# Warsaw Univ. (Poland).
ON THE RELATION BETWEEN DISCRETE AND CONTINUUM MECHANICS OF CERTAIN MATERIAL SYSTEMS c77
Cz. Wozniak *In* Polish Acad. Sci. Arch. Mech. 1976 p 571-581 refs (For primary document see N77-18853 09-70)
Copyright. Avail: Issuing Activity

Ways of deriving the discrete and the continuous models of material systems with complex (in general, discrete-continuous) structure were presented. The motion of the small parts of the system which are known are approximated by the family of homogeneous deformations. Next, the conditions of continuity of deformations and stresses among those parts are taken into account. The latter conditions lead to a special form of ideal constraints imposed on deformations and internal forces. The material systems under consideration are assumed to be hyperelastic, and only binary interactions are investigated.Author

N77-18877# Oak Ridge National Lab., Tenn.
TWO-DIMENSIONAL RELAXATION PROGRAM FOR SYSTEMS WITH INHOMOGENEOUS PERMEABILITY
W. E. Deeds (Tennessee Univ., Knoxville) and C. V. Dodd Jun. 1976 38 p refs
(Contract W-7405-eng-26)
(ORNL-TM-5333) Avail: NTIS HC A03/MF A01

A computer program is presented and explained which will solve axially symmetric eddy current problems, including those with permeable media present. An unusual feature is the combination of coarse and fine lattices, which permit rapid relaxation of coarse lattices in homogeneous regions to be combined with more accurate calculations using a fine lattice in the transition regions where the permeability is varying. Although the actual program listed is restricted to coils encircling a coaxial metal rod, the program can be modified to include any axially symmetric configuration. ERA

N77-18878# Yale Univ., New Haven, Conn. Becton Center.
COOPERATIVE PROPERTIES OF METAMAGNETIC MATERIALS Final Report, 1 Jun. 1972 - 30 Sep. 1976
Werner P. Wolf Jul. 1976 216 p refs
(Grant DA-ARO(D)-31-124-72-g169)
(AD-A031235; ARO-3960.14-P) Avail: NTIS HC A10/MF A01 CSCL 20/3

Metamagnetic materials are ordered magnetic materials which in low field have zero moment, corresponding to antiferromagnetic spin alignment, but as the field is increased they undergo a

more or less abrupt field induced phase transition to a state with a relatively large moment. The main body of the text consists of an extensive review of most of the published work in this field. It includes discussion of some 75 different materials described in almost 300 papers, and it reproduces over 200 figures of experimental results and extensive tables of important parameters. Author (GRA)

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N77-18879*# AiResearch Mfg. Co., Phoenix, Ariz.
ADVANCED ACOUSTIC AND AERODYNAMIC 20-INCH FAN PROGRAM Final Report
J. R. Erwin and R. W. Heldenbrand 15 Dec. 1977 94 p refs (Contract NAS3-18533)
(NASA-CR-135093; AiResearch-75-211789) Avail: NTIS HC A05/MF A01 CSCL 20A

The aerodynamic analyses, mechanical analyses, and stress tests of a 20-inch diameter advanced fan design intended for acoustic investigation by NASA-LeRC are discussed. A high tip speed transonic fan rotor was scaled directly to 20.0 inches (0.508 m) from a 28.74-inch (0.73-m) diameter rotor. A new stator was designed and fabricated for the fan and incorporated with a test rig housing and adapter hardware for installation in the NASA-LeRC Jet Noise Facility for acoustic evaluation. The stator was designed to allow mounting at three axial locations, and the fan, housing, and adapters are reversible so that either the inlet or the exhaust ends of the assembly face the open room of the test facility. Excellent aerodynamic performance is predicted, and a low noise signature is expected since the unique aerodynamic design features of this fan are directly conductive to producing minimum sound power. Author

DATA SUMMARY: Diverse data are presented; variables include weight, moments of inertia, stresses, strain, radius, angles, frequency, speed, torsional flutter parameter, Mach number.

N77-18880# Southampton Univ. (England). Inst. of Sound and Vibration Research.
THE EQUAL ENERGY CONCEPT APPLIED TO IMPULSE NOISE
A. M. Martin Jun. 1975 63 p refs Sponsored by Med. Res. Council
(ISVR-TR-77) Avail: NTIS HC A04/MF A01

Different types of impulse noise are discussed, and the energy concept for hearing damage is described. Available experimental evidence for applying the energy concept to impulse noise is presented and reviewed. It is concluded that temporary threshold shift from impulse noise is not adequately predicted by the energy rule. Persistent hearing loss on the other hand is accurately predicted by this rule in the case of industrial impulse noise, and it is concluded that the concept should be extended to encompass this type of noise. There is also some circumstantial evidence to indicate that the energy concept may also be applied to impulses with higher peak sound pressure levels, such as gunfire and other explosive sources. With the advent of the noise dosimeter, the energy concept represents a simple and unifying system for assessing the hazard to hearing from the majority of noises, which may be utilized by the non-expert. Author (ESA)

DATA SUMMARY: Maximum acceptable noise levels, frequency characteristics, and exposure durations/for rating industrial hearing hazards; the variables include impulse noise waveform, peak sound pressure, sound duration, sound level (db), noise threshold shift, decay time, repetition rate, age-corrected hearing level, immission level (db), audiometric test frequency, hearing loss trend curves, and exposure time; 18 figures and 3 tables.

N77-18881# National Aerospace Lab., Amsterdam (Netherlands). Scientific Services.
CALCULATION OF ACOUSTIC MODES IN AN INFINITE DUCT WITH SHEAR FLOW AND SOUND ABSORBING WALLS
J. J. Tiggelaar 16 Oct. 1975 37 p refs
(Contract NIVR-1773)
(NLR-TR-75137-U) Avail: NTIS HC A03/MF A01

The sound field of an infinitely long cylindrical duct with sound absorbing walls and carrying a shear flow was analyzed, and results calculated for a few mean flow profiles and for a particular non-zero wall admittance derived from an actual liner tried for the F-28 engine are presented. The equations, wave numbers, and various properties of the modes are discussed. Some calculated results are used to show the effects of shear flow and absorbing walls on the modes: refraction and redistribution of acoustic energy. The energy (intensity) calculations were made with the Cantrell-Hart formula. For further work, specific applications of the theory are proposed, together with extensions, notably the inclusion of a sound source. Author (ESA)

DATA SUMMARY: Acoustic wave propagation in a sheared fluid flowing through attenuating duct; the variables include propagation modes, sound fields, sound propagation, shear flow, acoustic attenuation, sound intensity, distribution, wall flow, and refractive shear effect; 14 figures and no tables.

N77-18882# Naval Research Lab., Washington, D.C.
SCATTERING THEORY FOR THE ACOUSTIC WAVE EQUATION IN AN ARBITRARY EXTERIOR DOMAIN
K. H. Chen and C. C. Yang 30 Aug. 1976 18 p refs
(AD-A030881; NRL-8030) Avail: NTIS HC A02/MF A01 CSCL 20/1

In this report the authors studied the spectral theory of the operator that is induced from problems in the n-dimensional Euclidean space (either in the exterior domain or in the whole space) for the hyperbolic linear partial-differential equations with the generalized Neumann boundary condition. The resulting theory provides a foundation for studying the wave operator and scattering operator involved in scattering theory and possibly also for studying the respective inverse problem. GRA

DATA SUMMARY: No numeric data are presented.

N77-18883# Wyle Labs., Inc., El Segundo, Calif.
ATMOSPHERIC ABSORPTION OF LOW FREQUENCY SOUND AT HIGH PRESSURES Final Report, 23 Jun. 1975 - 22 Jun. 1976
M. C. Lee and L. C. Sutherland Aug. 1976 35 p refs
(Contract DAHC04-75-C-0027)
(AD-A031058; WR-76-13; ARO-12916.2-E) Avail: NTIS HC A03/MF A01 CSCL 20/1

Results of a limited experimental study of atmospheric absorption in moist air at low frequencies are reported. The measurements were carried out in a resonance absorption tube at ratios of frequency to pressure of 4.6 to 403 Hz/atm. This extends the f/P range of laboratory measurements of absorption in air well below limits of previously published data in air of about 140 Hz/atm. The experimental apparatus was calibrated, using argon, over the same f/P range. The measured and predicted absorption in air and in argon generally agreed with existing theoretical models, although substantial deviations remain to be explained. Author (GRA)

DATA SUMMARY: Sound absorption in air at ratios of frequency to pressure of 4.6 to 403 Hz/atm.; the variables include pressure, humidity (percent mole), temperature, frequency/pressure range, absorption per wavelength, viscosity, specific heat ratio, air density, surface impedance, and volumetric absorption constant; 1 figure and 10 tables.

N77-18884# Texas Univ., Austin. Applied Physics Labs.
INITIAL PHASE OF A STUDY OF BOTTOM INTERACTION OF LOW FREQUENCY UNDERWATER SOUND Final Report, 1 Dec. 1974 - 30 Nov. 1975
Kenneth E. Hawker, Aubrey L. Anderson, Karl C. Focke, and Terry L. Foreman 6 Apr. 1976 182 p refs
(Contract N00039-75-C-0171)
(AD-A030858; ARL-TR-76-14) Avail: NTIS HC A09/MF A01 CSCL 20/1

Bottom interaction is recognized as an important and only partially understood component of low frequency underwater sound propagation. Several phases of this complex problem have been investigated during the first year of a planning multiple year study. Several phases of this complex problem have been investigated during the first year of a planned multiple year study. This report describes several aspects of the study including sensitivity of propagation loss to bottom loss variations, sensitivity of bottom loss to variations in ocean bottom physical parameters, bottom roughness effects, and propagation over a sloping bottom. Author (GRA)

DATA SUMMARY: Diverse data are presented; variables include depth, velocity, bottom loss, grazing angle, bottom depth, propagation loss, range, angles, transmission loss, and source angle.

N77-18885# Texas Instruments, Inc., Dallas. Central Research Labs.
ACOUSTIC ADAPTIVE TRANSVERSAL FILTER Final Technical Report, 24 Jan. 1975 - 1 May 1976
R. M. Hays Sep. 1976 167 p refs
(Contract DAAB07-75-C-1309; DA Proj. 1S7-62705-AH-94) (AD-A031063; TI-08-76-50; ECOM-75-C-1309-F) Avail: NTIS HC A08/MF A01 CSCL 20/1

The availability of spectral information in real-time clearly permits many important new signal processing applications. Although understanding the basic operating principles of the Transform Adaptable Processing System is more complex than is the case for a conventional programmable filter, its physical implementation is considerably simpler, since it consists of a small number of SAW chirp filters, mixers and amplifiers, and a timing generator. The capability of providing accurate transform information in real-time has been demonstrated, and prototype results for continuously variable bandpass/bandstop filtering, versatile programmable matched filtering, and prewhitening for suppression of narrowband interference evidence the power of the transform processing approach to many signal processing problems. This report has described this approach in detail and demonstrated its feasibility with extensive experimental results of the prototype Transform Adaptable Processing System. Author (GRA)

DATA SUMMARY: Diverse data are presented; variables include time, frequency, amplitude, and magnitude.

N77-18886# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
ANALYSIS OF ULTRASONIC WAVE SCATTERING FOR CHARACTERIZATION OF DEFECTS IN SOLIDS Annual Interim Report, 16 Mar. 1975 - 15 Mar. 1976
E. Richard Cohen May 1976 43 p refs
(Contract F44620-74-C-0057; AF Proj. 9782)
(AD-A030930; SC579.3IR; AFOSR-76-0754TR; AIR-2) Avail: NTIS HC A03/MF A01 CSCL 20/1

Measurements have been carried out on scattering of ultrasonic waves by a solid spherical inclusion (tungsten carbide) in titanium alloy. Both direct scattering and mode-converted scattering angular distributions were measured for both shear and compressional incident waves. The scattering from an arbitrary shape was expressed in terms of an integral equation from which an improved Born approximation was developed. In this formulation, the Born approximation reduces to the Rayleigh limit at low frequencies. Author (GRA)

DATA SUMMARY: Scattering distributions for incident compressional waves and incident shear waves at 2.25, 5.0, and 10.0 MHz; variables include relative power, scattering angle, and displacement amplitude; 11 figures include numeric data.

N77-18887# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
THE TECHNICAL FEASIBILITY OF NOISE CONTROL IN INDUSTRY
Aug. 1976 329 p refs Sponsored by Dept. of Labor
(PB-259792/0; COSHA-EFS-76-800) Avail: NTIS HC A15/MF A01 CSCL 20A

Machines are assigned to three categories of noise problems: no noise problem, noise problem identified, and noise problem unassigned. The unassigned at present contains most of the machines listed. Machines are also categorized as one of five types: process, not specific (a basic manufacturing process), heating and ventilating, material handling, and packaging. Where noise problems are identified, possible engineering controls are listed. Engineering controls considered include replacement of noise producing devices, treatments for large radiating surfaces, mufflers, enclosures, barriers, lagging, vibration isolation, personnel acoustic booths, and room acoustic treatment. GRA

DATA SUMMARY: No numeric data are presented.

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N77-18888# Naval Research Lab., Washington, D.C.
CALCULATED PHOTON SPECTRA AND RADIATION DOSE FROM 50 MeV ELECTRONS STOPPING IN AIR Final Report, 1 Sep. 1975 - 30 Jun. 1976
R. A. Lindgren Aug. 1976 22 p refs
(NRL Proj. H01-64)
(AD-A030016; NRL-MR-3335) Avail: NTIS HC A02/MF A01 CSCL 06/18

The bremsstrahlung spectrum and dose resulting from discharging a beam of 50 MeV electrons into air has been determined. Author (GRA)

N77-18889# Naval Research Lab., Washington, D.C. Plasma Dynamics Branch.
COLLISIONAL THEORY OF ELECTRICAL RESISTIVITY IN TRAPPED ELECTRON REGIMES
B. H. Hui, N. Winsor (Sci. Appl., Inc., McLean, Va.), and B. Coppi (MIT, Cambridge, Mass.) Aug. 1976 25 p refs
(Contract E(49-20)-1006; NRL Proj. H02-37)
(AD-A030168; NRL-MR-3349) Avail: NTIS HC A02/MF A01 CSCL 20/8

The distribution function is determined numerically for electrons subject to magnetic trapping, electron-electron and electron-ion collisions, and an electric field large enough to invalidate the Spitzer-Harm (classical) approximation. The electrical resistivity is determined and compared with analytical theory for Tokamaks. Author (GRA)

N77-18890# Washington Univ., Seattle. Dept. of Chemistry.
INTERMOLECULAR VIBRATION ENERGY TRANSFER IN THERMAL UNIMOLECULAR SYSTEMS
D. C. Tardy and B. S. Rabinovitch 15 Oct. 1976 102 p refs
(Contract N00014-75-C-0690; NR Proj. 092-549)
(AD-A031107; NR092-549-TR03) Avail: NTIS HC A06/MF A01 CSCL 20/8

A comprehensive review of energy transfer in thermal unimolecular systems in the period from 1920 to 1976 is given. Continuing areas of interest are described and results from related techniques are correlated. Author (GRA)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N77-18891* National Aeronautics and Space Administration. Pasadena Office, Calif.
NUCLEAR THERMIONIC CONVERTER Patent
Wayne M. Phillips (JPL) and Jack F. Mondt, inventors (to NASA) (JPL) Issued 15 Feb. 1977 5 p Filed 3 Oct. 1972 Supersedes N73-12702 (11 - 03, p 0332) Sponsored by NASA
(NASA-Case-NPO-13121-1; US-Patent-4,008,407;

US-Patent-Appl-SN-294727; US-Patent-Class-310-4R; US-Patent-Class-313-311; US-Patent-Class-346R) Avail: US Patent Office CSCL 10B

Efficient nuclear reactor thermionic converter units are described which can be constructed at low cost and assembled in a reactor which requires a minimum of fuel. Each converter unit utilizes an emitter rod with a fluted exterior, several fuel passages located in the bulges that are formed in the rod between the flutes, and a collector receiving passage formed through the center of the rod. An array of rods is closely packed in an interfitting arrangement, with the bulges of the rods received in the recesses formed between the bulges of other rods, thereby closely packing the nuclear fuel. The rods are constructed of a mixture of tungsten and thorium oxide to provide high power output, high efficiency, high strength, and good machinability. Official Gazette of the U.S. Patent Office

N77-18892# California Univ., Livermore. Lawrence Livermore Lab.
COLLISIONAL BROADENING OF X-RAYS MOVING IN SOLID TARGETS
R. J. Fortner, D. L. Mathews, J. D. Garcia (Arizona Univ., Tucson), and H. Oona (Arizona Univ., Tucson) 1976 16 p refs
(Contract N00014-75-C-0499; NR Proj. 393-017)
(AD-A029946) Avail: NTIS HC A02/MF A01 CSCL 20/8

In this paper high-resolution K X-ray spectra for boron (1 MeV) and neon (90 kev) projectiles moving in solid targets are reported. The X-ray transitions from the moving ions are found to be substantially broadened, compared to gas target spectral lines. Estimates of the extent of broadening are presented, and physical mechanisms responsible for it are discussed. Author (GRA)

74 OPTICS

Includes light phenomena.

N77-18893* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SYSTEM FOR PRODUCING CHROMA SIGNALS Patent
Kenneth H. Vorhaben (Lockheed Electronics Co., Houston, Tex.) and Phillip C. Lipoma, inventors (to NASA) (Lockheed Electronics Co., Houston, Tex.) Issued 18 Jan. 1977 3 p Filed 12 Sep. 1975 Supersedes N75-33835 (13 - 24, p 3102) Sponsored by NASA
(NASA-Case-MSC-14683-1; US-Patent-4,004,292; US-Patent-Appl-SN-612967; US-Patent-Class-358-44) Avail: US Patent Office CSCL 20F

A method for obtaining electronic chroma signals with a single scanning-type image device is described. A color multiplexed light signal is produced using an arrangement of dichroic filter stripes. In the particular system described, a two layer filter is used to color modulate external light which is then detected by an image pickup tube. The resulting time division multiplexed electronic signal from the pickup tube is converted by a decoder into a green color signal, and a single red-blue multiplexed signal, which is demultiplexed to produce red and blue color signals. The three primary color signals can be encoded as standard NTSC color signals. Official Gazette of the U. S. Patent Office.

DATA SUMMARY: No numeric data are presented.

N77-18894*# Transemantics, Inc., Washington, D.C.
ON THE ASTIGMATISM OF CONCAVE GRATINGS WITH SPHERICAL OR TOROIDAL SURFACES
H. Greiner and E. Schaffer Washington NASA Mar. 1977 22 p refs Transl. into ENGLISH from Optik (West Ger.), v. 16, n. 5, 1959 p 288-303
(Contract NASw-2792)
(NASA-TT-F-16771) Avail: NTIS HC A02/MF A01 CSCL 20F

Spectrographic toroidal gratings are compared to spherical gratings for their gain in incident light density or radiant flux. It is shown that a toroidal grating is advantageous depending on the lengths of the entrance or exit slits which are used under given experimental conditions. A toroidal grating is especially useful in a spectrometer when small entrance and exit slits are utilized. G.G.

DATA SUMMARY: No numeric data are presented.

N77-18895*# Kanner (Leo) Associates, Redwood City, Calif.
OPTICAL DEVICE, IN PARTICULAR AN AUTOCOLLIMATION
Klaus Hildebrand Washington NASA Feb. 1977 6 p Transl. into ENGLISH from West German patent no. 1094485 (Appl. no. A 31909 IX/42h, 25 Apr. 1969) 3 p
(Contract NASw-2790)
(NASA-TT-F-17303) Avail: NTIS HC A02/MF A01 CSCL 20F

An autocollimation device which produces two different colored marks in the image plane and a third color, formed by the addition of the two other colors, in the overlapping zone, is described. Author

DATA SUMMARY: No numeric data are presented.

N77-18896# Naval Research Lab., Washington, D.C.
ADSORPTION AND CONDENSATION OF WATER ON MIRROR AND LENS SURFACES Final Report
Joseph A. Curcio Sep. 1976 21 p refs
(NRL Proj. R05-31C)
(AD-A030871; NRL-MR-3359) Avail: NTIS HC A02/MF A01 CSCL 20/6

This is a report of a literature search on adsorption and condensation of water on mirror and lens surfaces. Adsorbed water films on clean surfaces are generally ~3.0 nm thick and can be ignored when considering absorption losses. When the surfaces are exposed to ambient conditions, various aerosols of dusts and hygroscopic particles are deposited on the surfaces which give rise to small losses by scattering of the incident radiation. In the case of hygroscopic particles the problem can be especially troublesome because here the scattering magnitude is a function of the relative humidity. For a given aerosol deposit an optical system containing a 6 mirror train will have a cumulative reflectivity decrease of about 7% as the relative humidity varies from 60% to 80%. Author (GRA)

DATA SUMMARY: Behavior of hygroscopic and continental particles exposed to increasing humidity; variables include relative humidity, particle radius, mirror temperature, photocurrent, wavelength, and particle size distribution.

N77-18897# Westinghouse Research Labs., Pittsburgh, Pa.
ION POLISHING OF OPTICAL SURFACES Final Report
R. A. Hoffman and W. J. Lange Kirtland AFB, N. Mex. AFWL Sep. 1976 73 p refs
(Contract F29601-75-C-0135; ILIR Proj. 75-04)
(AD-A030669; AFWL-TR-76-155) Avail: NTIS HC A04/MF A01 CSCL 20/6

In this study, various combinations of ion polishing and vacuum annealing were used in an attempt to reduce the optical absorptance and to smooth the surfaces of polycrystalline metal mirrors for high power lasers. The samples included micromachined copper and conventionally polished copper and molybdenum mirrors. It was found that ion polishing and vacuum annealing resulted in a large decrease 40 to 50%, in the absorptance at 10.6 micrometers for conventionally polished copper samples and a small decrease, 5 to 10%, in the absorptance of micromachined copper and conventionally polished molybdenum mirrors. After ion polishing and annealing, the absorptance of the conventionally polished copper mirrors was as low as that of the micromachined mirrors. Ion polishing proved beneficial in removing surface defects, such as machining marks, scratches, and embedded polishing grit, and oxide layers; however, for large amounts of material removed, differential sputtering of the various crystallites led to grain boundary delineation and surface roughening. Thus, there exists an optimum amount of material to be removed by ion polishing which results in both maximum removal of surface defects and minimum roughening of the surface. The optimum amounts were found to be: 2500 to 5000 A for micromachined copper, 5000 to 7000 A for conventionally polished copper, and less than 1500 A for molybdenum. Vacuum annealing of copper mirrors at 325 C for 1-1/4 hours

yielded a decrease in absorptance after ion polishing but at the expense of grain boundary enhancement; however, vacuum annealing of molybdenum at 800 C for 1 hour resulted in a decrease in absorptance with no evidence of surface roughening. GRA

DATA SUMMARY: Absorptance and microhardness of micromachined and conventionally polished copper and molybdenum samples after annealing and various stages of ion polishing; variables include absorptance, microhardness; 4 tables include numeric data.

N77-18898# Naval Electronics Lab. Center, San Diego, Calif.
EXPERIMENTAL TEST PLAN TO INVESTIGATE THE PROPAGATION OF BLUE/GREEN RADIATION THROUGH CLOUDS
G. C. Mooradian, M. Geller, L. B. Stotts, and H. G. Hughes 1 Oct. 1976 56 p refs
(AD-A030863; NELC-TN-3233) Avail: NTIS HC A04/MF A01 CSCL 20/6

It is the purpose of this test plan to define an experiment to measure the peak power losses and temporal characteristics as a function of the Field-of-view of optical pulses propagating through clouds (marine fogs). In addition to the propagation measurements the meteorological parameters describing the propagation path will be measured and used as inputs to computer codes to assess the measured results and for propagation prediction purposes. Of primary interest here are those frequencies in the blue-green portion of the spectrum which after propagating through a cloud, can penetrate sea water and be of use as a submarine-to-aircraft satellite communications system. GRA

DATA SUMMARY: The intensity of forward scatter and unscattered components are shown; variables include confidence limits, intensity, Mie scattering parameter, thickness, spatial spreading, total transmission, visibility, path loss power, and pulse stretching; 13 figures include numeric data.

N77-18899# Denver Research Inst., Colo. Div. of Mathematical Sciences.
AN APPROACH TO THE LIMITED APERTURE PROBLEM OF PHYSICAL OPTICS FARFIELD INVERSE SCATTERING
Robert D. Mager and Norman Bleistein 25 Aug. 1976 48 p refs
(Contracts N00014-76-C-0039; N00014-76-C-0079; NR Proj. 083-364; NR Proj. 041-434)
(AD-A030786; MS-R-7704) Avail: NTIS HC A03/MF A01 CSCL 20/6

The limited aperture problem of physical inverse scattering is examined i.e, the problem of identifying a target from an analysis of band-limiting viewing apertures. The target may be completely identified from an analysis of high frequency, bandlimited data. If the directions of viewing angles are limited as well, it is shown that the target surface can be identified where the target normal lies within the range of viewing directions outside of this range, no information is available. It is shown that this phenomenon is totally a feature of the Fourier transform of characteristic one-zero functions and independent of the inverse scattering formalism. Numerical examples are given for the case of a perfectly reflecting circular cylinder. GRA

DATA SUMMARY: Comparison of the exact Fourier transform for a perfectly reflecting circular cylinder target cross section with that predicted by the inverse diffraction technique; variables include wavenumber, exact Fourier transform, predicted Fourier transform, relative error; 1 table includes numeric data.

N77-18900# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. High Energy Laser Directorate.
INTERFEROGRAM ANALYSIS
Herbert Gray Jul. 1976 18 p refs
(AD-A030604; RH-7T-1) Avail: NTIS HC A02/MF A01 CSCL 20/6

Cumulative or destructive interference between two electromagnetic wave fronts arriving at a point and consequent occurrence of bright and dark bands or rings is a direct outcome of the wave nature of the propagation of electromagnetic energy. For the case of monochromatic wave fronts arriving at a point, the intensity of the radiation at the point in question can be shown to be a function of the Optical Path Difference. However, in order to obtain the pattern on a screen or in the focal plane of an optical detector, one has to make use of some optical elements. the only component which will contribute to effecting a change in the theoretically evaluated intensity pattern will be the lens system. The introduction of the lens system produces certain alterations in the pattern and these alterations are usually referred to as aberrations or, more particularly, the Seidel aberrations. An interferogram is a picture of an interference pattern and will always have all, or most of the aberrations present. An analytical study of an interferogram therefore is an approach to evaluate each of the aberrations in a photographed interferogram and use such evaluated information to detect the individual contributions of the various parameters which subscribe to the pattern. Author (GRA)

DATA SUMMARY: No numeric data are presented.

N77-18901# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
VISIBILITY AS AN ESTIMATOR OF INFRARED TRANSMITTANCE
J. Mason and G. B. Hoidale Jul. 1976 29 p refs
(DA Proj. 1T1-61102-B-53A)
(AD-A031040; ECOM-5598) Avail: NTIS HC A03/MF A01 CSCL 20/6

To assess the utility of visibility as an indicator of transmittance in the infrared, models depicting haze, fog, smoke, and dust were constructed such that all yielded identical transmittances at 0.55 micrometers (center of the visible spectrum), and transmittances at several infrared wavelengths (due to scattering only) were calculated. Results show that significant errors occur if visibility is relied upon. Author (GRA)

DATA SUMMARY: Effect of suspended particulate matter on light transmission in the battlefield environment; variables include wavelength, transmittance, composition, size distribution, and optical constants; 6 figures and 2 tables include numeric data.

N77-18902# Columbia Univ., New York. College of Physicians and Surgeons.
IMPROVED IMAGE PROCESSING Final Technical Report, Nov. 1974 - May 1976
Milton M. Kaplan Griffiss AFB, N.Y. RADC Jul. 1976 59 p refs
(Contract F30602-74-C-0187; AF Proj. 5534)
(AD-A030707; RADC-TR-76-223) Avail: NTIS HC A04/MF A01 CSCL 09/2

The design and evaluation of a unique electro-optical image processing system is discussed. The system simulates the compensatory mechanisms of the human visual system. The goal of the processing is the improvement of resolution in images degraded by Linear motion blur, defocus and diffraction. GRA

DATA SUMMARY: No numeric data are presemted.

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N77-18903# Argonne National Lab., Ill.
INFLUENCE OF WALL-JET GAS INJECTION ON LIQUID-METAL MHD GENERATOR PERFORMANCE
G. Fabris, R. L. Cole, R. G. Hantman, and E. S. Pierson 1976 8 p refs Presented at 15th Symp. on the Eng. Aspects of Magnetohydrodynamics, Philadelphia, 24 May 1976
(Contract W-31-109-eng-38)
(CONF-760556-2) Avail: NTIS HC A02/MF A01

A diverging-channel liquid-metal MHD generator with gas injection along the insulating walls yielded nearly-constant liquid velocity along the channel for near-design conditions, as desired

for best performance but expected significant improvement in performance over the previous constant-area-channel generator was not obtained. Experiments demonstrated that the generator performance improved slightly as the amount of gas injected was decreased, and that the injected gas was not forming the desired pure-gas wall layer. Companion air-water tests indicated that this was to be expected, and a one-dimensional computer model indicated that performance should be better without the partial flow obstruction of the gas injection ports. The gas injection ports were removed, and substantial improvement was obtained in generator performance. ERA

N77-18904# California Univ., Livermore. Lawrence Livermore Lab.

CONNECTION BETWEEN ADIABATICITY AND THE MIRROR MODE

Ronald H. Cohen 9 Jun. 1976 11 p refs

(Contract W-7405-eng-48)

(UCID-17158) Avail: NTIS HC A02/MF A01

The size of magnetic moment jumps of a particle in a long, thin equilibrium magnetic mirror field is shown to be related to the complex zeroes of the morror mode parameter B + 4pi dP/sub perpendicular//dB. A consequence is that adiabaticity places a lower limit on beta than does the mirror mode. ERA

N77-18905# Princeton Univ., N.J. Plasma Physics Lab.

PARAMETRIC INSTABILITITES EXCITED BY LOCALIZED PUMPS NEAR THE LOWER-HYBRID FREQUENCY

Y. Y. Kuo and Liu Chen Apr. 1976 26 p refs

(Contracts E(11-1)-3073; F44620-75-C-0037)

(MATT-1239) Avail: NTIS HC A03/MF A01

Parametric instabilities excited in non uniform plasmas by spatially localized pump fields oscillating near the local lower hybrid frequency are analytically investigated. Corresponding threshold conditions, temporal growth rates, and spatial amplification factors are obtained for the oscillating two stream instability and the decay instabilities due to nonlinear electron and ion Landau dampings. ERA

N77-18906# United Technologies Research Center, East Hartford, Conn.

HIGH BETA CAPTURE AND MIRROR CONFINEMENT OF LASER PRODUCED PLASMAS Semiannual Report, 1 Jul. 1975 - 31 Jan. 1976

Alan F. Haught, Donald H. Polk, Walter J. Fader, Richard G. Tomlinson, Raynard A. Jong, William B. Ard, Arthur E. Mensing, Thomas L. Churchill, John L. Stufflebeam, and Frank J. Bresnock (Rensselaer Polytechnic Inst., Troy, N. Y.) Jan. 1976 81 p refs

(Contract E(11-1)-2277)

(COO-2277-7; UTRC/R76-953200-24) Avail: NTIS HC A05/MF A01

A dense, mirror confined, target plasma is produced by high power laser irradiation of a solid lithium hydride particle, electrically suspended in a vacuum at the center of an established minimum-B magnetic field. Following expansion in and capture by the magnetic field, this target plasma is irradiated by an energetic neutral hydrogen beam. Charge exchange collisions with energetic beam particles serve to heat the confined plasma while ionization of the neutral beam atoms and trapping in the mirror magnetic field add particles to the confined target plasmas and initial studies of energetic neutral beam injection into confined target plasmas, conducted are presented. Improvements in the laser plasma production facility, the energetic neutral beam line, and the heavy ion probe diagnostic are reported. ERA

N77-18907# California Univ., Berkeley. Lawrence Berkeley Lab.

DIFFUSION DUE TO A SINGLE WAVE IN A MAGNETIZED PLASMA

G. R. Smith and A. N. Kaufman 10 May 1976 11 p refs Presented at Nobel Symp. on Nonlinear Effects in Plasmas, Lerum, Sweden, 11 Jun. 1976

(Contract W-7405-eng-48)

(LBL-5200; Conf-760635-3) Avail: NTIS HC A02/MF A01

Hamiltonian methods are used to study the motion of a particle in the field BZ and a single electrostatic wave. The particle motion is studied by numerically integrating the equations of motion. Diagrams of various particle trajectories are given. ERA

N77-18908# California Univ., Berkeley. Lawrence Berkeley Lab.

GENERALIZED PONDEROMOTIVE FORCES AND THREE-WAVE INTERACTION

S. Johnston and A. N. Kaufman 29 Apr. 1976 8 p refs Presented at Nobel Symp. on Nonlinear Effects in Plasmas, Lerum, Sweden, 11 Jun. 1976

(Contract W-7405-eng-36)

(LBL-5201; Conf-760635-1) Avail: NTIS HC A02/MF A01

A unified Hamiltonian approach to the theory of nonlinear interactions among waves and particles is discussed. The unifying feature of the approach is a generalization of the concept of pondermotive force. The usual method of time averaging is replaced by a canonical transformation. The transformation is designed to eliminate the terms in the Hamiltonian of a particle which are linear in the wave potentials, replacing them with bilinear terms at combination frequencies. An oscillation center approach is illustrated by deriving a compact general formula for the three-wave coupling coefficient in collisionless plasma. ERA

N77-18909# Princeton Univ., N.J. Plasma Physics Lab.

NUMERICAL STUDIES OF THE MHD SPECTRUM OF AN ELLIPTIC PLASMA COLUMN

M. S. Chance, J. M. Greene, R. C. Grimm, and J. L. Johnson May 1976 62 p refs

(Contract E(11-1)-3073)

(MATT-1246) Avail: NTIS HC A04/MF A01

The numerical procedure is described for determining the MHD spectrum associated with small perturbations about an analytic equilibrium. This configuration has magnetic flux surfaces which are nested similar elliptical cylinders generated by a uniform axial current. Since the system is periodic, it models the essential features of a toroid. The code is used to study the properties of modes in the continuous shear Alfven and slow acoustic spectra as well as the discrete modes associated with the fast magnetosonic waves and kinks. Modes where the interchange criterion is violated, or nearly violated, are investigated. ERA

N77-18910# California Univ., Livermore. Lawrence Livermore Lab.

LASER-START-UP SYSTEM FOR MAGNETIC MIRROR FUSION

A. M. Frank, S. R. Thomas, B. S. Denhoy, and A. K. Chargin 20 May 1976 33 p refs Presented at Conf. on Laser and Electro-Opt. Systems, San Diego, Calif., 24-27 May 1976

(Contract W-7405-eng-48)

(UCRL-78235; Conf-760513-9) Avail: NTIS HC A03/MF A01

A CO2 laser system was developed to provide hot start-up plasmas for magnetic mirror fusion experiments. A frozen ammonia pellet is irradiated with a laser power density in excess of 10 to the 13th power W/sq cm in a 50-ns pulse. This system uses commercially available laser systems. Optical components were fabricated both by direct machining and standard techniques. The technologies used in this system are directly applicable to reactor scale systems. ERA

N77-18911# California Univ., Livermore. Lawrence Livermore Lab.

COLLECTIVE BEHAVIOR IN RECENT LASER-PLASMA EXPERIMENTS

W. L. Kruer, R. A. Haas, W. C. Mead, D. W. Phillion, and V. C. Rupert 7 Jun. 1976 20 p refs Presented at Nobel Symp., Lerum, Switz., 10-18 Jun. 1976

(Contract W-7405-eng-48)

(UCRL-77730; Conf-760635-2) Avail: NTIS HC A02/MF A01

The absorption of 1.06 micron light focused on small C8H8 discs was measured in the intensity range of 10 to the 15th power to 10 to the 17th power W/cm. The data confirms the importance of collective plasma effects in determining the absorption of intense light. The measured absorption efficiencies are in the range of 30 to 40 percent, and the scattered light has a polarization dependence. The measured absorption are

inconsistent with classical inverse bremsstrahlung. Both the magnitude of the absorption and the observed polarization dependence of the scattered light are consistent with recent calculations of light absorption via collective processes. ERA

N77-18912# California Univ., Livermore. Lawrence Livermore Lab.
FOKN: A RELATIVISTIC FOKKER-PLANCK CODE WITH LARGE ANGLE SCATTERING AND RADIATION LOSSES
George Zimmerman, Ted Scharlemann, Lowell Wood, Tom Weaver, Terry Chu, and Geoffrey Lee Jul. 1976 37 p refs
(Contract W-7405-eng-48)
(UCID-17196) Avail: NTIS HC A03/MF A01

FOKN is a computer code which employs a relativistic Fokker-Planck algorithm to evolve the distribution functions of the various mutually interacting components of a multispecies plasma forward in time, with the optional addition of high angle, large energy and momentum transfer interactions between the various charged species of the plasma. As a computational expediency, the latter processes are handled by transfer matrices which are generated separately by another code, RNUX; so that, once specific transfer matrices are generated, they can be used over and over by FOKN provided the group structures are compatible. ERA

N77-18913# Air Force Weapons Lab., Kirtland AFB, N.Mex.
SHIVA PHASE II ELECTROMAGNETIC IMPLOSION RESEARCH Final Report
W. L. Baker, R. W. Boyd, E. J. T. Burns, R. S. Case, Jr., and R. H. Day Mar. 1976 157 p refs
(DNA Proj. NWED-QAXLB062)
(AD-A029794; AFWL-TR-74-307) Avail: NTIS HC A08/MF A01 CSCL 20/9

The goal of the SHIVA program is to develop a high energy X-ray source for survivability/vulnerability testing purposes. The basic approach is to produce a high energy, high density plasma by imploding large radius thin foil cylinders in a vacuum. The foil is accelerated to a very high velocity by the J x B force that results when a high current is passed axially through the cylinder. The desired radiation source is produced when the foil collides with itself at the center of the implosion creating a high density, high temperature plasma which loses most of its energy in a short burst of X-rays. During Phase II of the SHIVA program, the basic SHIVA concept was investigated both theoretically and experimentally. One and two-dimensional magnetohydrodynamic codes were used to theoretically determine the implosion characteristics and radiation output. The experimental feasibility of the SHIVA concept was studied by using a fast 250 kilojoule capacitor bank to drive the foil implosion. GRA

N77-18914# Austin Research Associates, Inc., Tex.
TURBULENT HEATING OF PLASMAS BY HIGH ENERGY PARTICLE BEAMS Final Report, 1 Jul. 1974 - 30 Jun. 1976
W. E. Drummond, J. R. Thompson, G. I. Bourianoff, D. E. Hasti, M. L. Sloan, and H. V. Wong Aug. 1976 126 p refs
(Contract F44620-72-C-0071; AF Proj. 9752)
(AD-A030176; ARA-236; I-ARA-76-U-80; AFOSR-76-1074tr) Avail: NTIS HC A07/MF A01 CSCL 20/9

During the performance period on this contract, 30 June 1976, substantial progress has been made in our research on the interactions of high energy beams of charged particles. The mechanisms and efficiency of energy transfer have been investigated from relativistic electron beams to much denser, high-z target plasmas. Provided that the beam quality is sufficiently well controlled, optimization of the primary beam-plasma interaction, through selection of beam density and energy, should permit at least 15% of the beam energy to be deposited during a single pass in targets near 100,000 times as dense as the beam. Estimation of ionization and radiation processes indicate that a beam-heated plasma source of multi-kilojoule, multigigawatt radiation in the 10 - 10,000 eV portion of the photon energy spectrum may be achievable. More recently a number of calculations have been completed relevant to the development of collective ion accelerators. Required conditions have been determined for both equilibria and stability of powerful, unneutralized electron beams propagating along a magnetic guide field. Also studied were the collective ionelectron cyclotron interaction which can occur between a non-neutral ultra-relativistic electron beam and a less dense species of ions. Various regimes of this interaction have been investigated, and in one important regime for which the instability growth rate is less than the transverse bounce frequency of the ions in the radial electric field of the electron beam, two dimensional computer simulations have been performed. GRA

N77-18915# Naval Postgraduate School, Monterey, Calif.
LASER PLASMA PARTICLE VELOCITIES M.S. Thesis
Daniel James Callahan Jun. 1976 127 p refs
(AD-A030079) Avail: NTIS HC A07/MF A01 CSCL 20/9

Experiments were performed on laser produced plasma from aluminum target discs in a vacuum chamber at pressures a few times (10 to the (-6) power) torr. Plasma analysis was achieved using a floating double electrostatic probe of tungsten wires biased at -15 volts DC. In analyzing 376 oscilloscope trace pictures of the probe signal, four velocity signals occurred with regularity. The plasma velocities detected by the probe were determined to be 3.7 X (10 to the 7th power) cm/sec, 1.5 X (10 to the 7th power) cm/sec, 5.6 X (10 to the 6th power) cm/sec (the bulk of the plasma), and 4.0 X (10 to the 6th power) cm/sec. A fifth, very fast signal at 1.0 X (10 to the 8th power) cm/sec was also detected but it was not consistently present. Investigation of the velocity distributions as a function of time showed them not to be Boltzmann distributions, but exponential power distributions. GRA

N77-18916# Naval Postgraduate School, Monterey, Calif.
LASER GENERATED MAGNETIC FIELDS M.S. Thesis
Francis Thomas Williamson, Jr. Jun. 1976 88 p refs
(AD-A030082) Avail: NTIS HC A05/MF A01 CSCL 20/9

A sequence of laser pulses focussed onto the same spot on a target produces evaporation of target material and the formation of a crater with crater depth increasing from shot to shot. An experimental study of the crater-depth dependence of the magnetic fields generated by the laser produced plasmas has been performed. Repeated irradiation of an aluminum target with a laser pulse of 10 to the 12th power W/cm squared in a low background pressure of air at 10 to the (-5) power Torr produced magnetic fields as high as 1500 G and at a rate of .055 mm/shot excavated a hole nearly 4 mm deep and 2 mm wide at the target surface. Optical micrographs were taken of the target crater surface and of craters sectioned for examination by a scanning electron microscope. An independent determination of the plasma-electron temperature was obtained from the X-ray emission continuum of the plasma. GRA

N77-18917# Naval Postgraduate School, Monterey, Calif.
X-RAY DiAGNOSTICS OF LASER-PRODUCED ALUMINUM PLASMAS M.S. Thesis
Sydney A. Shewchuk Jun. 1976 126 p refs
(AD-A030085) Avail: NTIS HC A07/MF A01 CSCL 20/9

Electron temperatures have been evaluated using the x-ray emission from plasmas created by irradiating a solid Aluminum target with a 500MW, 25nsec Nd laser. Studies of the x-ray emission from the plasma at 5 x (10 to the 11th power) W/(cm squared) using the two foil absorption method indicated temperatures ranging from 136 to 185eV. No suprathermal activity was detected for the foil combinations used. Temperature was related to laser flux density by the scaling factor 0.404. Observed temperature remained constant for cratering with up to 25 laser pulses focused at the same spot. Preliminary measurements indicated x-ray intensity was proportional to (p sup 1/4) over the range 10 to 300 microns. Initial work was completed on a vacuum photodiode useful for high resolution photon detection in the soft x-ray region of the spectrum. GRA

N77-18918# Naval Research Lab., Washington, D.C.
FURTHER NUMERICAL STUDY OF THE DISSIPATIVE TRAPPED-ELECTRON INSTABILITY IN TOKAMAKS INCLUDING MAGNETIC CURVATURE DRIFT RESONANCES Interim Report
K. R. Chu (Sci. Appl., Inc., McLean, Va.) and Wallace M. Manheimer Aug. 1976 17 p refs
(AEC Proj. AT-49-20; NRL Proj. H02-37)
(AD-A029381; NRL-MR-3336) Avail: NTIS HC A02/MF A01 CSCL 20/9

The dispersipn relation for the dissipative trapped electron mode including the effects of magnetic shear, finite ion Larmor radius, banana-plateau velocity spare separation, magnetic curvature drift resonance, and ion-ion collisions, etc. is used to examine the plasma stability of recent tokamak experiments. Regimes of importance of various effects in these experiments are also discussed. Instabilities mostly occur at k sub theta rho approximately 7, where k sub theta is the azimuthal wave number and p sub i is the ion Larmor radius. The often used anomalous heat/conduction coefficient, predicts losses comparable to those observed in TFR, ST, and ATC. Author (GRA)

N77-18919# California Univ., Los Angeles. Plasma Physics Group.
STABILITY OF SHELL DISTRIBUTIONS
D. D. Barbosa Jul. 1976 25 p refs
(Contract N00014-76-C-0307)
(AD-A030582; PPG-269) Avail: NTIS HC A02/MF A01 CSCL 20/9

Stability criteria for parallel propagating plasma waves driven unstable by a nearly isotropic bump-in-energy half-shell beam of electrons along a magnetic field are investigated. Comparison with the drifting Maxwellian at equal densities reveals smaller growth rates for the half-shell and a shift in the unstable wave numbers towards smaller phase velocities. The limit of complete isotropy is stable to the waves under consideration.
Author (GRA)

N77-18920# California Univ., Los Angeles. Dept. of Electrical Science and Engineering.
WAVES AND INSTABILITIES IN STEADY STATE HIGH BETA PLASMAS Final Report, 15 May 1972 - 30 Jun. 1976
N. C. Luhmann, Jr. and Francis F. Chen Jul. 1976 62 p refs
(Grant AF-AFOSR-2339-72; AF Proj. 9751)
(AD-A030924; UCLA-ENG-7672; AFOSR-76-1101TR) Avail: NTIS HC A04/MF A01 CSCL 20/9

The generation of steady-state, high-density, fully-ionized plasmas in magnetically confined arcs and jets has been studied. Finite-beta waves and instabilities appropriate to the ionospheric and magnetospheric plasmas have been investigated. Anomalous resistivity due to instability produced turbulent fluctuations has been studied. Experimental simulations of laser-plasma interactions have been performed in the microwave region. Author (GRA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N77-18921*# Alabama Agricultural and Mechanical Coll., Normal.
THE STUDY OF CRYSTALS FOR SPACE PROCESSING AND THE EFFECT OF O-GRAVITY
R. B. Lal Feb. 1977 43 p refs
(Grant NsG-8033)
(NASA-CR-149672; AAMU-NAS-002) Avail: NTIS HC A03/MF A01 CSCL 20L

The mechanism of crystal growth was studied by solution technique and how it was affected by space environment. Investigation was made as to how space processing methods are used to improve the promising candidate materials for different devices. Author

N77-18922# California Univ., Berkeley. Lawrence Berkeley Lab.
OPTICAL DIFFRACTION STUDY OF THE STACKING SEQUENCES IN SILICON CARBIDE
David R. Clarke and Gareth Thomas Mar. 1976 5 p refs Presented at the 34th Electron Microscopy Soc. of Am. Ann. Meeting, Miami Beach, Fla., 9 Aug. 1976
(Contract W-7405-eng-48)
(LBL-4971; CONF-760803-1) Avail: NTIS HC A02/MF A01

A combination of lattice fringe imaging by electron microscopy and optical diffraction was used to identify stacking periodicities in hot-pressed silicon carbide. Analysis of the patterns reveals 5, 7, 8, 9, 10, 13, 16, and 20 composite Si-C closepacked layers. ERA

N77-18923# Ames Lab., Iowa.
THRESHOLD SWITCHING IN THE AMORPHOUS SEMICONDUCTOR As15Te70Ge15 AND IN THE ORGANIC SEMICONDUCTOR MELANIN Ph.D. Thesis
C. H. Culp, III Jun. 1976 129 p refs
(Contract W-7405-eng-82)
(IS-T-709) Avail: NTIS HC A07/MF A01

Measurements of delay time, energy and average resistance as functions of applied voltage were made by a computer controlled data acquisition system. These measurements were made on As15Te70Ge15 at 243, 273 and 298 K. A time dependent electrothermal model was solved numerically and used to measure activation energy, sample thickness, conductivity at T equal to infinity, and area of the electrodes. The calculation was compared to the experimental values of delay time, energy, and average resistance as functions of applied voltage. The measured data and the calculations are in good agreement. Melanin exhibits threshold switching at low electric fields (about 100 V/cm). The results from the melanin experiments show that threshold switching in melanin can be explained by a thermal runaway model. A pseudo-memory effect was also found in melanin. ERA

N77-18924# Oak Ridge National Lab., Tenn.
ANOMALOUSLY LARGE HALL EFFECT IN Cr2S3
V. Kh. Oganesyan [1976] 2 p refs Transl. into ENGLISH from Izv. Akad. Nauk Arm. (USSR), v. 4, 1969 p 402-403
Sponsored by ERDA
(ORNL-TR-4181) Avail: NTIS HC A02/MF A01

In studies of galvano-magnetic effects in sulfides, anomalously large values of the Hall coefficient were found in Cr2S3. The anomalously large Hall effect in Cr2S3 may be explained by the modern zone theory of solid bodies and the approximately unipole model with inclusion of quantum-mechanic assumptions concerning s to d exchange interaction of valence electrons. Strong localization of valence electrons in the nuclei of the atoms leads to a decrease in the concentration of free electrons and an anomalously large Hall effect. It is obvious if, in the compound Cr2S3 after corresponding transfer of electrons the chromium atom has an electron configuration that is not d to the 5th power or d to the 10th power, then under determined conditions it would be expected to be superconductive. ERA

N77-18925# Oak Ridge National Lab., Tenn.
SOLID STATE DIVISION Annual Progress Report, period ending 31 Dec. 1975
M. K. Wilkinson and F. W. Young, Jr. May 1976 177 p
(Contract W-7405-eng-26)
(ORNL-5135) Avail: NTIS HC A04/MF A01

Research activities are reported in programs on theoretical solid state physics, physical properties of solids, radiation effects in metals, neutron scattering, research materials, and isotope research materials. ERA

N77-18926# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLID STATE RESEARCH Quarterly Technical Summary Report, 1 Feb. - 30 Apr. 1976
Alan L. McWhorter 15 May 1976 71 p refs
(Contract F19628-76-C-0002; AF Proj. 649L)
(AD-A030861; TN-1975-4; ESD-TR-76-113) Avail: NTIS HC A04/MF A01 CSCL 20/12

This report covers in detail the solid state research work of the Solid State Division at Lincoln Laboratory. The topics covered are Solid State Device Research, Quantum Electronics, Materials Research, Microelectronics, and Surface-Wave Technology. Funding is primarily provided by the Air Force, with additional support provided by the Army (BMDATC), ARPA (MSO, IPTO), NSF, and ERDA. GRA

N77-18927# Naval Research Lab., Washington, D.C.
RESEARCH ON GUNN EFFECT MATERIALS (III-V COMPOUNDS) Annual Report, 1 Jul. 1975 - 30 Jun. 1976
H. Lessoff and E. Swiggard Sep. 1976 47 p refs
(AD-A030864; NRL-MR-3360) Avail: NTIS HC A03/MF A01 CSCL 20/12

Several novel preparation techniques are reported to prepare high purity semi-insulating GaAs single crystals having minimum impurity doping. The growth techniques for InP single crystals are reported. A new method to prepare epitaxial GaAs on in-situ cleaned substrates is presented. Author (GRA)

N77-18928# Sussex Univ., Brighton (England).
EXPERIMENTS ON THE FORMATION AND SURFACE STATES OF ADSORBED HELIUM FILMS Final Technical Report, Jul. 1974 - Jul. 1976
D. F. Brewer Jul. 1976 56 p refs
(Grant DA-ERO-124-74-G-0046)
(AD-A031258; ARDG(E)-R/D-2092) Avail: NTIS HC A04/MF A01 CSCL 20/12

This report contains a summary of results on (1) relaxation times in monolayer and submonolayer He3 films adsorbed on Vycor porous glass, (2) density of adsorbed helium deduced from capacitance measurements, and (3) progress on a modified POMERANCHUK cooling project. For the first item the report summarizes several recently developed phenomenological models in an attempt to explain some of the properties of He3 in Vycor porous glass. Several experiments are suggested which may help in discrimination between the various models. The second item refines this research groups view on the correlation between the density and the dielectric constant of the system under investigation based on some recent experimental evidence. The third portion of the report contains information on the group's efforts to extend their cooling range down to helium 1.2mK.
Author (GRA)

N77-18929# California Univ., San Diego. La Jolla Inst. for Pure and Applied Physical Sciences.
SUPERCONDUCTIVITY AND LATTICE INSTABILITIES Final Report, 1 Oct. 1971 - 30 Sep. 1976
Bernd T. Matthias 30 Sep. 1976 42 p refs
(Contract F44620-72-C-0017; AF Proj. 9764)
(AD-A031231; AFOSR-76-1134TR) Avail: NTIS HC A03/MF A01 CSCL 20/13

During the past five years four distinct advances in the science of superconductivity have been made (1) Many new superconductors were discovered. Really high critical temperatures have for the first time been discovered in non-cubic materials. (2) Overwhelming evidence for a connection between moderate-to-high-temperature superconductivity and low temperature structural instability was found. Work on both the occurrence and the pressure dependence of superconductivity and lattice instability in zirconium-vanadium, hafnium-vanadium, lanthanum-ruthenium, ruthenium-vanadium, copper-molybdenum-sulfide, copper-molybdenum-selenide, zinc-molybdenum-sulfide, gold-zinc, lanthanum-sulfide, and lanthanum-selenide shows that the connection between the two phenomena is very general. (3) An empirical correlation between the shape of electrical resistivity versus temperature curve of a given superconductor and its transition temperature was developed despite incomplete understanding of its nature, this correlation was found to be useful in predicting superconductivity in some cases. (4) The transition temperatures of magnesium and gold 5 x 10-4 and 2 x 10-4 k, respectively were found by means of extrapolation.
GRA

N77-18930# Dayton Univ., Ohio.
RESEARCH AND DEVELOPMENT ON CHARACTERIZATION OF ELECTROMAGNETIC MATERIALS, PART 2 Final Report, 17 Apr. 1972 - 30 Jun. 1974
Duane Earley, Priscilla Franklin, Richard Harris, and Sara Stevens Wright-Patterson AFB, Ohio AFML Dec. 1975 168 p refs
(Contract F33615-72-C-1666; AF Proj. 7360)
(AD-A031161; UDRI-TR-74-32; AFML-TR-74-37-Pt-2) Avail: NTIS HC A08/MF A01 CSCL 20/12

This report is in two sections. The first section covers research on thermodynamic property measurements and calculations of (Hg,Cd,Te) system, CdTe, ZnSe, samarium, cobalt and titanium-iron alloy systems. A bibliography on high temperature mass spectrometry from Chemical Abstracts from 1970-1973 includes 343 references. The second section includes chemical physical studies on dye laser materials. Dye laser materials were characterized as to: (1) absorption spectrum, (2) fluorescence emission spectrum, (3) radiative decay lifetime of fluorescence, (4) intersystem crossing rate and triplet-triplet absorption spectrum, and (5) various laser emission parameters.
Author (GRA)

N77-18931# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
OPTICAL STUDIES OF ION IMPLANTED SPECIES IN GROUP IV AND III-V SEMICONDUCTORS Final Report, 1 Jun. 1971 - 31 May 1976
W. G. Spitzer 1976 17 p
(Grant AF-AFOSR-2075-71; AF Proj. 9763)
(AD-A029553; AFOSR-76-1028TR) Avail: NTIS HC A02/MF A01 CSCL 20/2

This is the final report of a grant to study the optical properties of ion implanted semiconductors. The materials studied are primarily GaAs and GaP. High energy ion implants were studied by measuring the changes in the near infrared dielectric constant, the localized mode absorption and the reflection near the fundamental lattice vibrational band. The implantation process produces substantial changes in all three properties including increases in the high frequency dielectric constant, observable impurity-induced absorption bands, and a total alteration of the reststrahlen behavior. Post implantation annealing of these changes has also been investigated. The material has all been published and a list of the papers is included in the report.
Author (GRA)

N77-18932# Stanford Univ., Calif. Electronics Labs.
STUDY OF THE ELECTRONIC SURFACE STATE OF III - V COMPOUNDS Semiannual Technical Progress Report
W. E. Spicer 15 Mar. 1976 80 p refs
(Contract DAAK02-74-C-0069; Grant NSF DMR-73-02351; DARPA Order 2182)
(AD-A030225) Avail: NTIS HC A05/MF A01 CSCL 20/12

Contents: Summary; Overview; Synchrotron Radiation Studies of Electronic Structure and Surface Chemistry of GaAs, GaSb, and InP--Core Shifts on Oxygen Exposure, Effect of O2 and Cs on Fermi Level Pinning of GaSb, Electronic Structure of the (110) GaAs Surface, Partial Yield Studies; Determination of the Oxygen Binding Site on GaAs (110) Using Soft X-Ray Photoemission Spectroscopy; Photoemission Studies of Surface States and Schottky Barrier Formation on InP. GRA

N77-18933# Stanford Research Inst., Menlo Park, Calif.
ION IMPLANTATION IN CADMIUM TELLURIDE
T. J. Magee, J. Gibbons, J. Bean, J. Peng, and R. Armistead Aug. 1976 124 p refs
(Contract N00014-73-C-0378; SRI Proj. PYU-2676)
(AD-A030153) Avail: NTIS HC A06/MF A01 CSCL 20/12

Results of investigations conducted on cadmium telluride (CdTe) samples are presented in this two-part document. Part 1 describes the effects of ion implantation doping in CdTe using transmission electron microscopy (TEM) and electrical evaluation as investigative tools. Part 2 describes the investigation of microstructural defects in CdTe and interfacial reactions at the Pt/CdTe contact and subsequent correlations with electrical measurements on CdTe room-temperature gamma ray detectors, and possible solar cell uses. This study has shown that the previous experimental data obtained on arsenic and krypton-implanted samples can be explained by the radiation-induced formation of electrically active defects rather than by substitutional impurity doping. A model has been proposed entailing the liberation of cadmium vacancy acceptors from radiation-induced loops. Using column I dopants (potassium, sodium, and cesium) to fill available cadmium cacancy sites, high doping efficiencies and true chemical doping have been obtained in ion-implanted CdTe. Investigations of CdTe radiation detector materials have shown a direct correlation between defect content, excess leakage currents and polarization on fabricated devices. GRA

N77-18934# Oak Ridge National Lab., Tenn.
INVERSE MEAN FREE PATH, STOPPING POWER CSDA RANGE, AND STRAGGLING IN Ni, Cu, AND Au FOR ELECTRONS OF ENERGY S OR EQUAL 10 keV CALCULATED FROM A STATISTICAL MODEL Interim Report, Mar. - Jun. 1976
J. C. Ashley, C. J. Tung, R. H. Ritchie, and V. E. Anderson

Griffiss AFB, N. Y. RADC Jun. 1976 36 p refs Sponsored in part by ERDA
(DNA Proj. NWED-QAXTA040)
(AD-A029449; RADC-TR-76-220; IR-3) Avail: NTIS HC A03/MF A01 CSCL 20/12

A statistical model is described and employed to calculate inverse mean free path, stopping power, and mean square energy loss for electrons of energy from 0.5 eV to 10 keV above the Fermi level in several solids. From these calculations, electron range in the continuous-slowing-down approximation and straggling are evaluated for electron energies from 10 eV to 10 keV. Table of these quantities are presented for the solids Ni, Cu, Ag, and Au. Graphical displays of the inverse mean free path and stopping power for these four solids are also included.
GRA

N77-18935# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
INVESTIGATION OF TECHNOLOGICAL PROBLEMS IN GaAs Semiannual Report, 1 Jul. 1975 - 15 Jan. 1976
Fred H. Eisen, John A. Higgins, Anthony A. Immorlica, Kuvas L. Reidar, and Burt W. Ludington May 1976 142 p refs
(Contract F19628-75-C-0113; ARPA Order 2489; AF Proj. 5638)
(AD-A030599; SC5017.7SAR; RADC-TR-76-176; SAR-2) Avail: NTIS HC A07/MF A01 CSCL 20/12

Significant progress in areas of GaAs technology with impact on the development of microwave FET devices is reported. In growth and evaluation of semi-insulating substrate material, improvements in the crystalline quality of the material by elimination of backfill inert gases in the growth system leading to better yield and progress in the characterization of semi-insulating GaAs by the interpretation of transport measurements in terms of models for the electrical compensation are reported. In liquid phase epitaxial growth high reproducibility and uniformity of ultra-thin (0.5 micrometer) FET layers was demonstrated; resistivity of 40,000 ohms-cm was achieved in Cr-doped buffer layers by sensitive control of the bakeout temperature of the melt. Remarkable progress was made in ion implantation by demonstrating high reproducibility and uniformity of S implanted layers, and by achieving high doping efficiency in low and high dose Se implantation. FET devices made from Se implanted GaAs show negligible post-tuning drift characteristics in device noise figure compared to transistors made of LPE material. In the area of interest of IMPATT diodes, a strong dependence of the ionization rates on doping density was observed.
Author (GRA)

N77-18936# California Univ., San Diego. Dept. of Physics.
ELASTIC INTERACTION OF TWO ATOMS ADSORBED ON A SOLID SURFACE
K. H. Lau and Walter W. Kohn Sep. 1976 21 p refs
(Contract N00014-76-C-0050; NR Proj. 017-653)
(AD-A030910; TR-37) Avail: NTIS HC A02/MF A01 CSCL 20/12

The long-range interaction of two adsorbed atoms mediated by the elastic distortion of the substrate is calculated classically for an elastically isotropic substrate. For identical atoms, the interaction is repulsive; for different atoms, it can be repulsive or attractive. It varies as 1/rho cubed with the distance rho between the two adsorbed atoms. This is the same spatial dependence as for the dipole-dipole interaction between two adsorbed atoms. For two xenon atoms adsorbed on silver, the elastic interaction is about one order of magnitude smaller than the dipole-dipole interaction. The interaction energy is inversely proportional to the shear modulus of the substrate, so that it may become quite large near a distortive phase transition.
Author (GRA)

N77-18937# Harry Diamond Labs., Adelphi, Md.
RARE EARTH ION-HOST LATTICE INTERACTIONS. 9: LANTHANIDES IN YAsO4
Donald E. Wortman, Nick Karayianis, and Clyde A. Morrison Aug. 1976 105 p refs
(DA Proj. 1T1-61102-AH-46; HDL Proj. 308637)
(AD-A030658; HDL-TR-1772) Avail: NTIS HC A06/MF A01

Phenomenological even-fold crystal field parameters, B(km) for D(2d) site symmetry are determined that yield a least-rms deviation of 6.7 cm between calculated and measured energy levels for Er(3-) in YAsO4. Crystal field components, A(km), are determined by a sum over the YAsO4 lattice, and B(km) are then calculated for the lanthanides in this material. These parameters are used to calculate Stark split energy levels and squared-matrix elements of the electric dipole operator between the energy states for the triply ionized lanthanides in YAsO4.
Author (GRA)

N77-18858# Technische Hochschule, Dresden (East Germany). Dept. of Physics.
DERIVATION OF A GENERALIZED CONTINUUM THEORY FOR HETEROGENEOUS MATERIALS
G. Diener, Ch. Raabe, and H.-G. Schoepf *In* Polish Acad. Sci. Arch. Mech. 1976 p 325-332 refs (For primary document see N77-18853 09-70)
Copyright. Avail: Issuing Activity

N77-18860# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.
THEORIES WITH CARRIER FIELDS: MULTIPLE-INTERACTION NONLOCAL FORMULATIONS
D. G. B. Edelen *In* Polish Acad. Sci. Arch. Mech. 1976 p 353-368 refs (For primary document see N77-18853 09-70)
Copyright. Avail: Issuing Activity

N77-18862# Geneva Univ. (Switzerland).
COUPLED HYDRODYNAMIC MODES NEAR STRUCTURAL PHASE TRANSITIONS IN CRYSTALS
C. P. Enz *In* Polish Acad. Sci. Arch. Mech. 1976 p 384-392 refs (For primary document see N77-18853 09-70)
Copyright. Avail: Issuing Activity

N77-18863# Stuttgart Univ. (West Germany).
THE NONLOCAL THEORY OF ELASTICITY AND ITS APPLICATION TO INTERACTION OF POINT DEFECTS
B. K. D. Gairola *In* Polish Acad. Sci. Arch. Mech. 1976 p 393-404 refs (For primary document see N77-18853 09-70)
Copyright. Avail: Issuing Activity

N77-18867# Ceskoslovenska Akademie Ved, Prague.
NON-PLANAR DISLOCATION CORES
F. Kroupa *In* Polish Acad. Sci. Arch. Mech. 1976 p 442-454 refs (For primary document see N77-18853 09-70)
Copyright. Avail: Issuing Activity

N77-18868# Max-Planck-Institut fuer Metallforschung, Stuttgart (West Germany).
ORDERED VERSUS DISORDERED MATERIALS: CONSEQUENCES FOR THE CONTINUUM MODEL
E. Kroener *In* Polish Acad. Sci. Arch. Mech. 1976 p 455-465 refs (For primary document see N77-18853 09-70)
Copyright. Avail: Issuing Activity

N77-18869# Liege Univ. (Belgium).
PLASTIC DEFORMATION OF FCC POLYCRYSTALS IN THE MICROSTRAIN REGION
J. Lambermont *In* Polish Acad. Sci. Arch. Mech. 1976 p 257-278 refs (For primary document see N77-18853 09-70)
Copyright. Avail: Issuing Activity

N77-18871# Muenster Univ. (West Germany).
INVARIANCE CONDITIONS IN THE TRANSMISSION FROM DISCRETE LATTICE MODELS TO THE CONTINUUM LIMIT
W. Ludwig *In* Polish Acad. Sci. Arch. Mech. 1976 p 501-515 refs (For primary document see N77-18853 09-70)
Copyright. Avail: Issuing Activity

N77-18873# McGill Univ., Montreal (Quebec). Micromechanics of Solids Lab.
THE EFFECTIVE ELASTIC RESPONSE OF RANDOMLY ORIENTED POLYCRYSTALLINE SOLIDS IN TENSION
J. W. Provan and D. R. Axelrad *In* Polish Acad. Sci. Arch Mech. 1976 p 531-547 refs (For primary document see N77-18853 09-70)
Copyright. Avail: Issuing Activity

N77-18874# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.
THE PASSAGE FROM A PARTICLE SYSTEM TO A CONTINUUM MODEL
R. S. Rivlin *In* Polish Acad. Sci. Arch. Mech. 1976 p 549-561 refs Sponsored by NSF (For primary document see N77-18853 09-70)
Copyright. Avail: Issuing Activity

N77-18875# Polish Academy of Sciences, Warsaw.
QUASICONTINUUM THEORY OF CRYSTALS
D. Rogula *In its* Arch. Mech. 1976 p 563-569 refs (For primary document see N77-18853 09-70)
Copyright. Avail: Issuing Activity

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N77-18938*# Florida Univ., Gainesville. Dept. of Nuclear Engineering Sciences
THERMODYNAMIC PROPERTIES OF A HIGH PRESSURE SUBCRITICAL UF6/He GAS VOLUME (IRRADIATED BY AN EXTERNAL SOURCE)
David E. Sterritt (Tenn. Valley Authority), George T. Lalos (Naval Surface Weapons Center), and Richard T. Schneider Dec. 1976 43 p refs
(Grant NGL-10-005-089)
(NASA-CR-149661) Avail: NTIS HC A03/MF A01 CSCL 20M

A computer simulation study concerning a compressed fissioning UF6 gas is presented. The compression is to be achieved by a ballistic piston compressor. Data on UF6 obtained with this compressor were incorporated in the simulation study. As a neutron source to create the fission events in the compressed gas, a fast burst reactor was considered. The conclusion is that it takes a neutron flux in excess of 10 to the 15th power n/sec sq cm to produce measurable increases in pressure and temperature, while a flux in excess of 10 to 19th power n/sq cm sec would probably damage the compressor. Author

N77-18939# Lockheed Missiles and Space Co., Palo Alto, Calif.
NUMERICAL SOLUTION OF THE KINETICS PROBLEM OF AVALANCHE IONIZATION STIMULATED BY A POWER LIGHT PULSE
R. A. Vlasov, Z. P. Zhvavyi, and G. M. Rubanova [1977] 3 p refs Transl. into ENGLISH from Zh. Prikl. Spectra. (USSR), v. 31, no. 5, 1976 p 924-926
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The quatum kinetic equation describing shock ionization of transparent dielectrics with a one photon energy set by electrons in a light field is discussed as being among the type of equations with a shifted argument. The energy losses by electrons during collisions with phonons are described. M.C.F.

N77-18876# Warsaw Univ. (Poland).
ON THE RELATION BETWEEN DISCRETE AND CONTINUUM MECHANICS OF CERTAIN MATERIAL SYSTEMS
Cz. Wozniak *In* Polish Acad. Sci. Arch. Mech. 1976 p 571-581 refs (For primary document see N77-18853 09-70)
Copyright. Avail: Issuing Activity

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N77-18940# Defense Dept., Washington, D.C.
MANAGING KNOWLEDGE AS A CORPORATE RESOURCE
J. F. Berry and C. M. Cook 28 May 1976 71 p refs
(AD-A029891) Avail: NTIS HC A04/MF A01 CSCL 05/10

Knowledge (as opposed to data or information) is proposed as a basic resource of an enterprise. The differences and interdependencies among data, information, and knowledge are discussed along with some ideas on what constitutes effective knowledge management for an enterprise. Three views of data management (Structural, Functional, and Physical) are put forward as necessary to the proper understanding of the data management activity of an enterprise. The Structural View is used to outline potential problems in knowledge management and to list several areas where further research and development are needed. Finally, a logical system design for possible implementation is suggested along with a discussion of essential managerial steps which should be taken to achieve corporate knowledge management.
Author (GRA)

N77-18941# California Univ., Berkeley. Inst. of Industrial Relations.
INTERPERSONAL, WORK GROUP, AND ORGANIZATIONAL COMMUNICATIONS: A SYSTEMIC APPROACH TO UNDERSTANDING ORGANIZATIONS Final Report
Karlene H. Roberts and Charles A. Oreilly Aug. 1976 59 p refs
(Contract N00014-69-A-0200-1054)
(AD-A029401; TR-13) Avail: NTIS HC A04/MF A01 CSCL 05/1

This final report of a research program supported by the Office of Naval Research discusses the various aspects of the research program and indicates where it stands to date. The report also indicates future research suggested by some of our findings, and mentions points of departure we are taking from this initial set of empirical investigations. Some possibilities for application of our results are mentioned. The report summarizes information from previous technical reports in an attempt to tie together the entire research program. Some data not reported elsewhere are presented as well. The overall intent of the research program was to assess organizations as social-psychological systems, using the general concept of communication as a unifying variable across individuals, their work groups, and the organizations in which these groups function. Author (GRA)

N77-18942# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
THE WRM INFORMATION SYSTEM M.S. Thesis
Dennis A. Carlson and Carlos M. Talbott, Jr. Jun. 1976 185 p refs
(AD-A030242; SLSR-15-76A) Avail: NTIS HC A09/MF A01 CSCL 05/1

In this research, an information system was developed which analyzes MAJCOM WRM data files. The system manipulates data in the RCS: HAF LGS (M) 7107 report and the WCDO, WMP-V, and 2C data files to provide overage and shortage inventory information. Further, it provides an ability to compute WRM requirements for any unplanned contingency force and to compare those requirements with on-hand status information. The FORTRAN program was written to investigate the following research hypothesis: given changes in a USAF general war or contingency plan, the response time in determining the adjustments to be made in WRM stockpiles can be reduced by

automated analysis of WRM data files. Statistical and operational evaluations supported this hypothesis. The research also addresses several management information system design considerations used in developing the prototype system. The considerations differentiate data from information and suggest that automated analysis systems should produce information useful for managerial decision making. Included with the research are the computer program and instructions for its implementation and operation. Author (GRA)

N77-18943# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

A STUDY OF INFLUENCE METHODS USED BY PROJECT AND FUNCTIONAL MANAGERS IN A MATRIX ORGANIZATIONAL ENVIRONMENT M.S. Thesis

Leonard J. Melhart, Jr. Jul. 1976 165 p refs
(AD-A030299; GSM/SM/76S-18) Avail: NTIS HC A08/MF A01 CSCL 05/1

Modern development projects are costly and involve many complex interdependent tasks. To facilitate the accomplishment of these tasks, the matrix organizational concept has evolved. It is employed by both industry and government and is intended to aid the decision making process by allowing flexible horizontal and diagonal relationships. A unique feature of this concept is the multiple supervision of project personnel. In essence, project personnel have a dual allegiance to and are influenced by project and immediate functional managers. Under this arrangement project managers do not have formal authority over project personnel and therefore must rely on other types of influence methods. The influence methods that are exercised in this unique situation are the primary concern of this study. GRA

N77-18944# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.

AN ANALYSIS OF THE RELATIONSHIP BETWEEN MANUFACTURER ASSEMBLY TIME AND INTERMEDIATE-LEVEL MAINTENANCE REPAIR TIME M.S. Thesis

Prescott D. Farris Jun. 1976 73 p refs
(AD-A030229; SLSR-11-76A) Avail: NTIS HC A04/MF A01 CSCL 15/5

Numerous models have been developed for predicting logistic support costs of which intermediate-level maintenance repair time is an important consideration. However, the major problem is obtaining accurate input data elements to drive the models. The current technique of using historical data extrapolation has proven successful in some cases, yet additional improvement is required. One approach which could circumvent the utilization of historical data is the use of the manufacturer's initial assembly time to predict the intermediate-level maintenance time required to repair a unit. The purpose of this study was to evaluate the relationship between assembly time and repair time. Avionics communication-navigation units were selected as a study vehicle, and the relationship was statistically analyzed through regression analysis. The results obtained failed to indicate that a significant relationship exists between manufacturer assembly time and intermediate-level maintenance repair time; therefore, the study did not provide a viable alternative to the use of the historical data for predicting maintenance repair time. GRA

N77-18945# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.

AN INVESTIGATION OF THE DCAS MANAGEMENT INFORMATION SYSTEM AS A SOURCE OF INFORMATION FOR ALLOCATION OF PROCUREMENT QUALITY ASSURANCE MANPOWER RESOURCES M.S. Thesis

Louis R. Albani, William J. Manley, and Roger A. Sindle Jun. 1976 95 p refs
(AD-A030313; SLSR-6-76A) Avail: NTIS HC A05/MF A01 CSCL 15/5

This research was directed at determining if the Dayton Defense Contract Administration Service District (DCASD) Management Information System (MIS) could be of value to the Quality Assurance (QA) manager in the allocation of manpower resources. Data representing 131 contractors under the cognizance of the Dayton DCASD during the period July through December 1975 were collected and analyzed. One data element reported in the MIS, corrective action hours, was expected to be related to product quality. The research was aimed at determining what QA activities and other MIS variables were predictors for the number of hours expended in corrective action. Multiple regression analysis was used both to describe the existing relationships between corrective action hours as a dependent variable and the independent variables in the MIS, and to develop a model useful in predicting corrective action hours. GRA

N77-18946# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.

APPLICABILITY OF DESIGN-TO-COST TO SIMULATOR ACQUISITION M.S. Thesis

Kaleem Hazer, Jr. and Daniel L. Ringler Jun. 1976 168 p refs
(AD-A030231; SLSR-36-76A) Avail: NTIS HC A08/MF A01 CSCL 14/1

A decision model for determining the appropriateness of applying the Design-to-Cost (DTC) concept to a particular weapons acquisition program had not previously been available within the Air Force Systems Command (AFSC). To formulate such a model, an extensive literature review was made to identify program characteristics which other writers considered necessary or desirable to the successful application of the DTC concept. A set of these characteristics was validated through a structured managerial interview schedule. From this set of characteristics the decision model was designed and applied to the AFSC simulator acquisition process as an example for employing the model. Although many of the characteristics applicable to DTC were also applicable to simulator acquisitions, the authors concluded from the model that the DTC concept would not be applicable for the few simulators normally procured in a small but highly competitive civilian market. However, if a large number of simulator systems had to be procured and then produced on an assembly line basis or if a new system or component that was not available in private industry had to be developed, then DTC would be applicable. This decision model can be applied to other AFSC acquisition programs. Author (GRA)

N77-17997*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SCAR PROGRAM OVERVIEW

F. Edward McLean *In its* Proc. of the SCAR Conf., Part 1 1976 p 1-4 (For primary document see N77-17996 09-01) Avail: NTIS HC A21/MF A01 CSCL 05A

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N77-18947# Oak Ridge National Lab., Tenn.

INDICES, A TECHNIQUE FOR USING LARGE SPATIAL DATA BASES

A. H. Voelker Apr. 1976 84 p refs
(Contract W-7405-eng-26)
(ORNL-RUS-15) Avail: NTIS HC A05/MF A01

Computerized techniques for isolating factors or indices relevant to management questions and for expressing these indices in elements of a data base are presented. Indices of potential use to resource managers developed for the land-use models of the Regional Environmental Systems Analysis program (RESA) are also provided. ERA

N77-18948# Los Alamos Scientific Lab., N.Mex.

PROBLEMS ASSOCIATED WITH LARGE SCIENTIFIC DATA BASES

Jesse M. Cheadle, III 1976 21 p Presented at Conf. of Assoc. of System 2000 User's for Tech. Exchange, Austin, Texas, May 1976
(Contract W-7405-eng-36)
(LA-UR-76-1152; Conf-760545-1) Avail: NTIS HC A02/MF A01

Large data bases were encountered in the national uranium

resource evaluation project. The solutions to the major problems encountered in dealing with large scientific data bases are as follows: limited disk space is not a problem if one uses PLF or PLC update codes to create or add to data bases; skewness can be minimized by occasional reorganizations; and running statistical packages can be easily accomplished by running them against data files created by the S2K 'LIST' command. ERA

N77-18949# California Univ., Livermore. Lawrence Livermore Lab.
RESEARCH LEADING TO THE PRODUCTION AND EARLY USE OF NUMERIC DATA BANKS OF MATERIAL PROPERTIES AND SYSTEM ANALYSES Quarterly Progress Report, Jan. - Mar. 1976
E. A. Henry 14 May 1976 18 p
(Contract W-7405-eng-48)
(UCRL-50038-76-1; QPR-1) Avail: NTIS HC A02/MF A01

Research was initiated leading to creation of a numerical data base of material properties. A list of tasks to be completed was compiled and a literature survey in energy storage, flywheel rotor materials, and battery-storage systems was started. ERA

N77-18950# Defense Documentation Center, Alexandria, Va.
COMPUTERS IN INFORMATION SCIENCES: COMPUTER COMPONENTS Report Bibliography, Jun. 1972 - Jun. 1976
Oct. 1976 333 p
(AD-A031200; DDC/BIB-76/09) Avail: NTIS HC A15/MF A01 CSCL 09/2

This bibliography is a compilation of citations on Computers in Information Sciences; Computer Components. Discussed are computer memory devices, data storage systems, arithmetic and logic units, and punched card equipment. Corporate Author-Monitoring Agency, Subject, Title and Personal Author are included. Author (GRA)

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N77-18951# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
A MIXED INTEGER PROGRAMMING APPROACH TO SYNTHETIC FLIGHT TRAINER ACQUISITION M.S. Thesis
Roger E. Elstun and Robert M. Howe 16 Jun. 1976 111 p refs
(AD-A030215; SLSR-31-76A) Avail: NTIS HC A06/MF A01 CSCL 05/9

The ever increasing use of synthetic flight trainers (SFTs) in U.S. Air Force flight training programs makes necessary efficient and cost-effective SFT acquisition. This thesis presents a mathematical model which employs a mixed integer linear programming approach to analyze the comparative costs and task-training capabilities of proposed SFTs. In addition to detailing the model, the thesis presents an example formulation in which the model was used to evaluate the SFTs proposed for the flight training program for initial qualification in the A-10 aircraft. From the results of the example formulation, the authors concluded: that mixed integer linear programming models are useful for selecting the most economical SFT or combination of SFTs to complement an aircraft in a flight training program, that the evaluation of SFTs should include several proposed SFTs with various task-training capabilities rather than a limited number of SFTs with similar task-training capability, that part-task SFTs may be a cost saving means of providing flight simulation, and that SFTs are an economical means of lowering flight training program costs. GRA

N77-18952# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
A TAXONOMY OF COST ESTIMATING CHARACTERISTICS AS APPLIED TO AN AIRCRAFT REPLENISHMENT SPARES MODEL M.S. Thesis
Eric E. Nelson and William E. Smith Jun. 1976 206 p refs
(AD-A030239; SLSR-01-76A) Avail: NTIS HC A10/MF A01 CSCL 15/5

Department of Defense cost estimation requires improvement, particularly as it applies to budgetary estimates for major weapon system acquisitions. This research explores ways of improving cost estimating methodology by the development of a taxonomy of cost estimating characteristics which may be used as a guide in constructing and evaluating cost estimating models. Such a guide was developed on a framework of systems theory and applied to the construction of a conceptual model designed to estimate replenishment investment spares budgetary requirements for the Air Force Logistics Command (AFLC) in support of major weapon systems acquisitions. The taxonomy of cost estimating characteristics was then used to evaluate the conceptual model and the present AFLC replenishment investment spares model. The research demonstrated the usefulness of a taxonomy of cost estimating characteristics and concluded that budgetary estimates for replenishment investment spares could be improved. Author (GRA)

N77-18953# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
LIFE CYCLE COST MODELS FOR DURABLE VERSUS DISPOSABLE PACKAGE DECISIONS M.S. Thesis
James A. Arnestad and Samuel C. Emerson Jun. 1976 118 p refs
(AD-A030293; SLSR-26-76A) Avail: NTIS HC A06/MF A01 CSCL 15/5

The Department of Defense (DOD) and its service branches have placed increasing attention on defense expenditures. The importance of finding new cost reduction methods cannot be over-emphasized. DOD packaging costs are significant. These costs can probably be reduced by the application of proven management techniques. This research effort applies accepted life cycle cost techniques to the area of packaging decisions. The application of these techniques can act as a decision tool for selecting preferred alternatives. Air Force Logistics Command (AFLC) packaging managers have indicated that a life cycle cost model would be of invaluable assistance to their Air Logistics Center (ALC) item managers (IM) as well as Air Force Systems Command's System Program Offices (SPO), in the selection of package types. GRA

N77-18044*# McDonnell-Douglas Corp., St. Louis, Mo.
MARKET TRENDS
Richard D. Fitzsimmons *In* NASA. Langley Res. Center Proc. of the SCAR Conf., Pt. 2, 1976 16 p refs (For primary document see N77-18019 09-01)
Avail: NTIS HC A23/MF A01 CSCL 05C

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N77-18954*# California Univ., Berkeley.
THEY WATCH AND WONDER. PUBLIC ATTITUDES TOWARD ADVANCED TECHNOLOGY Final Report
Todd LaPorte and Daniel Metlay Dec. 1975 344 p refs

(Grant NGR-05-003-0471)
(NASA-CR-149673) Avail: NTIS HC A15/MF A01 CSCL 05K

The relationship of technological development to individual and community response was investigated to provide a general conceptual, as well as empirical basis, for an understanding of the impact of advanced technologies on social life. Results of the surveys are presented in tables and graphs. Author

N77-18955# California Univ., Livermore. Lawrence Livermore Lab.
METHOD OF ASSESSING STRATEGIES FOR TRANSPORTATION ENERGY CONSERVATION
C. J. Anderson and S. J. LaBelle Apr. 1976 17 p refs
(Contract W-7405-eng-48)
(UCRL-52051) Avail: NTIS HC A02/MF A01

A method of strategy assessment is proposed to guide the analyst in developing energy conservation programs in the transportation sector. The strategies are described and their impacts projected within a well defined future (the scenario). The impacts on selected decision variables such as economic impact or energy use impact are assessed. A decision is made based on a judgment of values and priorities are set upon which to make recommendations. ERA

N77-18956# Massachusetts Univ., Amherst. Water Resources Research Center.
EFFECTIVENESS OF INFORMATION TRANSFER THROUGH WATER RESOURCES RESEARCHER/USER GROUP INTERACTION Completion Report
Ruth Kreplick and John C. Sawyer Jun. 1976 157 p refs
(Contract DI-14-31-0001-5021; OWRT Proj. A-076-MASS(1))
(PB-258767/3; Completion-FY-76-17; Pub-73; W77-00151) Avail: NTIS HC A08/MF A01 CSCL 05K

The interpersonal user group approach was utilized to communicate relevancy of water resources research to local, state, and federal agency personnel. Approximately 100 professionals participated in stages of the project, from experience interviews to interaction in 18 informal meetings. Discussion is presented in the context of pertinent studies, communication patterns and systems, perceptions of institutional arrangements, current utilization and fields related to research utilization. The effectiveness of interpersonal communication was measured by a questionnaire on the awareness and attitude dimensions. GRA

N77-18957# National Swedish Road and Traffic Research Inst., Linkoeping.
DEVELOPMENT OF TRANSPORT STATISTICS FOR STRATEGICAL PLANNING MEASURES IN THE ROAD AND TRAFFIC AREA. ANALYSIS OF REQUIREMENTS AND PROGRAMME [UTVECKLING AV TRANSPORTSTATISTIK FOER BEREDSKAPSAETGAERDER INOM OMRAEDET VAEG- OCH GATUTRAFIK. BEHOVSANALYS OCH PROGRAM]
Anders Brodin and Boerje Thunberg 1976 57 p refs In SWEDISH; ENGLISH summary
(VTI-75) Avail: NTIS HC A04/MF A01

A program to include a presentation of the need for more articulated transport statistics for the planning and follow-up of strategic measures concerning road and street traffic and a plan of future action are described. The various transport statistics needed are also discussed. ESA

N77-18958# National Swedish Road and Traffic Research Inst., Linkoeping.
VEHICLE NOISE FROM COARSE TEXTURE PAVEMENTS [TRAFIKBULLER FRAAN GROV VAEGYTA]
Olle Andersson 1976 24 p refs In SWEDISH; ENGLISH summary
(VTI-91) Avail: NTIS HC A02/MF A01

Vehicle induced noise from roads with surface dressing with maximum particle size between 16 and 25 mm is compared. Reference tests were made on neighboring pavements with asphaltic concrete. The measurements were made on Road E3 near Mariefred and Road E4 between Sundsvall and Haernoesand, all being test roads. The vehicle was run at 70 km/hour with the engine idling during the measurements. The difference found between the noise levels from dressings with different chip size was 2-3 dB, whereas the difference between surface dressing and asphaltic concrete amounted to 5-10 dB. The difference between summer tires and studded winter tires was 3-5 dB. Author (ESA)

N77-18959# Bureau of Mines, Tucson, Ariz.
UTILIZATION OF CLEAR WATER SEWAGE EFFLUENT IN MINERAL PROCESSING Completion Report
Walter W. Fisher Aug. 1976 43 p refs
(Contract DI-14-34-0001-6003)
(PB-257842/5; W76-12464; OWRT-A-046-Ariz(1)) Avail: NTIS HC A03/MF A01 CSCL 13B

Secondary treated sewage effluent was substituted for normal process water in laboratory tests simulating the unit operations of agitation leaching, solvent extraction and froth flotation applied to copper ores. The combined processes of agitation leaching followed by solvent extraction were not adversely affected by sewage effluent. However, froth flotation recovery of copper and molybdenum sulfides showed significant detrimental response to sewage effluent. GRA

N77-18960# New Mexico State Univ., University Park. Water Resources Research Inst.
TIME PARAMETER EVALUATION IN DUAL FLOCCULANT DESTABILIZATION. REPRODUCIBILITY EVALUATION OF THE FLOCCULATION OF A SYNTHETIC LATEX COLLOIDAL SYSTEM
Bryan F. Duff, William A. Barkley, and Shen-Chih Wu Mar. 1976 106 p refs Sponsored by Office of Water Res. and Tech.
(PB-257736/9; WRRI-062; W76-12211;
OWRT-A-047-NMEX(2)) Avail: NTIS HC A06/MF A01 CSCL 13B

An optimum time differential between the addition of dual flocculants, aluminum sulfate and polyelectrolytes, to a synthetic colloidal suspension latex was investigated. The dependent parameters for destabilization measurement were turbidity, total solids, zeta potential, and Al(3+) concentration. Various alum concentrations, polyelectrolyte concentrations, and time intervals were examined. For the cationic polyelectrolyte, the optimum time for addition was dependent upon amount of alum used, but the cationic polyelectrolyte should always be added after the alum. The optimum time for the anionic polyelectrolyte was 5 minutes after alum had been added to the system. GRA

N77-18961# Environmental Protection Agency, Washington, D.C. Office of Solid Waste Management Programs.
DECISION-MAKERS GUIDE IN SOLID WASTE MANAGEMENT
Robert A. Colonna, Cynthia McLaren, and Emily Sano, ed. 1976 187 p refs
(PB-258266/6; EPA-SW-500) Avail: NTIS HC A09/MF A01 CSCL 13B

A guide discussing key issues of solid waste management in a decision-making context is presented. It attempts to anticipate all of the important decisions which local government managers must make in the effort to develop and operate solid waste programs in a responsive, cost-effective manner. Each chapter presents an issue, describes the alternatives, gives the advantages and disadvantages, and concludes with a summary statement which may include an EPA recommendation on the issue. GRA

N77-18962# Environmental Protection Agency, Washington, D.C.
MODEL PLAN OF STUDY, SUPPLEMENT TO: GUIDANCE FOR PREPARING A FACILITY PLAN, MUNICIPAL WASTEWATER TREATMENT WORKS CONSTRUCTION GRANTS PROGRAM
Mar. 1976 13 p Sponsored by EPA
(PB-257650/2; EPA-430/9-76-004-Suppl; EPA-MCD-24) Avail: NTIS HC A02/MF A01 CSCL 13B

A fictitious community is used to illustrate the amount of detail required from a grant applicant to fulfill regulatory requirements for preparing a plan of study for construction of a publicly owned facility in a small or medium size community. GRA

N77-18963# Environmental Protection Agency, Washington, D.C. Municipal Construction Div.

FEDERAL GUIDELINES: INDUSTRIAL COST RECOVERY SYSTEMS, MUNICIPAL WASTEWATER TREATMENT WORKS CONSTRUCTION GRANTS PROGRAM

Feb. 1976 32 p refs

(PB-257651/0; EPA-MCD-45) Avail: NTIS HC A03/MF A01 CSCL 13B

The Federal Water Pollution Control Act Amendments of 1972 require that industrial users of municipal wastewater treatment works make payments for the portion of the cost of construction of such treatment works (as determined by the Administrator) which is allocable to the treatment of such industrial wastes. These guidelines are published to establish general minimum guidance and to inform industrial users, grantees, regional administrator, and the public concerning industrial cost recovery. The guidelines increase understanding, assist preparation, simplify evaluation, and accelerate approval, implementation and maintenance of industrial cost recovery systems. GRA

N77-18964# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.

MODELS FOR ASSESSING TRIP DEPENDABILITY IN AUTOMATED GUIDEWAY TRANSIT NETWORKS

D. L. Kershner and W. J. Roesler Aug. 1976 64 p refs

(Contract DOT-UT-30010)

(PB-258129/6; APL/JHU-CP-047/JPR-036; UMTA-MD-06-0018-76-2) Avail: NTIS HC A04/MF A01 CSCL 13B

Equipment failures and how to correct them are significant factors affecting the quality of service of automated guideway transit (AGT) systems. A procedure is described which permits evaluation of the group rapid transit networks in terms of trip dependability. The model uses a flow representation of vehicle traffic determined by network topography, demands for travel, and operational service policy. The model has its most useful application in the intermediate design stage where there are tradeoffs to be evaluated. GRA

N77-18965# Duke Univ., Durham, N.C. Dept. of Civil Engineering.

EXPERIMENTS IN GUIDEWAY - LEVITATION VEHICLE INTERACTION DYNAMICS Final Report, Jun. 1974 - Jan. 1976

James F. Wilson Jan. 1976 88 p refs

(Contract DOT-FR-4-4098)

(PB-257941/5; FRA/ORD-76/259) Avail: NTIS HC A05/MF A01 CSCL 13F

The design and interpretation of laboratory scale dynamic experiments of vehicles traversing multiple-span or cable-stayed guideways are presented. The nondimensional parameters of such systems, including critical span bending moments and vehicle heave accelerations, are derived. A point load vehicle and two vehicles closely resembling advanced operational prototypes were designed and tested: the 150 mph prototype tracked air cushion vehicle (PTACV), and the 300 mph tracked levitated research vehicle (TLRV). General experiments based on these dimensionless system parameters are designed and the capability of instrumentation and data processing minicomputers to measure and interpret response data is evaluated. Discussions and comparisons of response data for critical six and three-span guideway moments and for rms vehicle heave accelerations are included. GRA

N77-18966# Engineering-Science, Inc., Berkeley, Calif.

WASTEWATER TREATMENT FACILITIES, GRANBY SANITATION DISTRICT, GRANBY, COLORADO Final Environmental Impact Statement

Denver EPA Aug. 1976 360 p refs

(Contract EPA-68-01-2392)

(PB-258155/1) Avail: NTIS HC A16/MF A01 CSCL 13B

The construction of expanded wastewater treatment facilities is proposed to replace the existing plant, which serves some 600 permanent and about 1000 visitors in the Granby area. The proposal to build the new facility, with provisions for nitrification of effluent and with discharge to the Fraser River, was prompted by population growth projections mainly associated with a large proposed second home/resort complex adjacent to Granby named Val Moritz. Environmental impacts and alternatives are presented. GRA

N77-18967# Arizona Univ., Tucson. Div. of Economic and Business Reuse.

ENERGY COSTS OF WASTEWATER REUSE Final Report

David E. Pingry 1 Sep. 1976 14 p refs

(Contract DI-14-34-0001-6003)

(PB-257518/1; W76-12215; OWRT-A-068-ARIZ(1)) Avail: NTIS HC A02/MF A01 CSCL 13B

Functions were estimated using regression techniques which relate cost and energy use of wastewater treatment plants to measures of flow, treatment load and level of use. The sample of plants is drawn from Arizona and consists of plants which are or could be engaged in wastewater reuse. The resulting functions are used to estimate net water gain from reuse. In addition, bounds on the value of water relative to energy which are necessary for reuse to be economical are calculated. GRA

N77-18968# Delaware State Coll., Dover. Dept. of Chemistry.

WATER CHEMISTRY

George R. Seidel 1976 338 p

(PB-258697/2) Avail: NTIS HC A15/MF A01 CSCL 07D

A minicourse of water chemistry designed to solve engineering and pollution problems for the conservationist, the legislator, the mining engineer, the agricultural engineer, the forester, the civil engineer and the municipal planning engineer is presented. GRA

N77-18969# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

WASTEWATER RENOVATION BY A PROTOTYPE SLOW INFILTRATION LAND TREATMENT SYSTEM Technical Report, Jun. 1974 - May 1975

I. K. Iskander, R. S. Sletten, D. C. Leggett, and T. F. Jenkins Jun. 1976 55 p refs

(DA Proj. 4A7-62720-A-896)

(AD-A029744; CRREL-76-19) Avail: NTIS HC A04/MF A01 CSCL 08/7

The feasibility of a slow-infiltration land treatment system as an alternative to advanced waste treatment of wastewater was studied using six outdoor test cells. Wastewater was applied to forage grasses by spray irrigation. Parameters studied were wastewater application rate, effect of pretreatment and soil type and seasonal effects on the treatment system. Activated sludge pretreatment of the applied wastewater did not improve the overall quality of the product water from this slow-infiltration system. The uptake of nutrients by forage grasses accounted for significant removal of nitrogen and phosphorus from applied wastewater during the growing season. Other renovative mechanisms, namely nitrification/denitrification of applied nitrogen and phosphorus immobilization and fixation by the soils may have accounted for further renovation of the applied effluents. GRA

N77-18970# Florida Inst. of Tech., Melbourne. Univ. Center for Pollution Research.

EFFECT OF GAMMA RAYS ON MICROORGANISMS AND CHEMICALS IN WATER, WASTEWATER, AND SLUDGE Final Report, 1 Jul. 1971 - 31 Dec. 1975

D. D. Woodbridge and P. C. Cooper 6 Feb. 1976 179 p refs

(Contract DAAK02-71-C-0296; DA Proj. 4A7-62719-AT-41) (AD-A029680; USAFESA-RT-2009) Avail: NTIS HC A09/MF A01 CSCL 13/2

Gamma rays have been found to be effective in destroying certain chemical structures and in killing both pathogenic and non-pathogenic bacteria. A synergistic effect has been discovered when aqueous solutions are either pretreated with chlorine or when air or oxygen are bubbled through the solutions during irradiation. The data indicates that the effectiveness of the irradiation process is dependent on the concentration of solids in the aqueous solution. GRA

N77-18971# Environmental Protection Agency, Washington, D.C. Monitoring and Data Support Div.

MINIMAL REQUIREMENTS FOR A WATER QUALITY ASSURANCE PROGRAM

1976 23 p Sponsored by Environmental Monitoring and Support Lab., Cincinnati
(PB-258807/7; EPA-440/9-75-010) Avail: NTIS HC A02/MF A01 CSCL 13B

An outline which describes a typical Memorandum of Understanding is provided along with overall requirements for a water laboratory quality assurance program. Basic elements that are an integral part of a continuing program are also cited. Author

N77-18972# Virodyne Corp., Littleton, Colo.
TECHNOLOGY ASSESSMENT FOR NEW WATER DEVELOPMENT PROJECTS, VOLUME 1 Final Technical Completion Report
J. C. Kellogg Aug. 1976 499 p refs
(Contract DI-14-31-0001-9062)
(PB-259276/4; W77-00527; OWRT-C-4319(9062)(1)) Avail: NTIS HC A21/MF A01 CSCL 13B

In using the theme that water resources planning is future-oriented, methods of technology assessment are utilized for tracing possible effects of legislative proposals, technologies or other water actions and programs which may pre-ordain a whole lifestyle change in the region. Three clusters of technology assessment methods are used to illustrate the usefulness of this approach, namely descriptive (e.g., dynamic modeling and cross-impact matrices); predictive (such as trend extrapolation and correlation); and, prescriptive (includine Delphi, decision trees and scenarios). GRA

N77-18973# Public Technology, Inc., Washington, D.C.
TRAFFIC SIGNALIZATION SYSTEMS. AN INFORMATION BULLETIN OF THE TRANSPORTATION TASK FORCE OF THE URBAN CONSORTIUM FOR TECHNOLOGY INITIATIVES
Beth Irons French Oct. 1976 31 p refs
(Contract DOT-OST-60076)
(PB-258733/5; DOT-TST-77-7) Avail: NTIS HC A03/MF A01 CSCL 13B

The process of choosing, selecting, installing and operating a traffic signal system is described. Issues and problems covered include alternative types of signal systems, system selection, and system evaluation and cost. Also included is a list of contacts and an annotated bibliography. GRA

N77-18974# Public Technology, Inc., Washington, D.C.
TRANSPORTATION FOR ELDERLY AND HANDICAPPED PERSONS. AN INFORMATION BULLETIN OF THE TRANSPORTATION TASK FORCE OF THE URBAN CONSORTIUM OF TECHNOLOGY INITIATIVES
Beth Irons French Oct. 1976 37 p refs
(Contract DOT-OST-60076)
(PB-258734/3; DOT-TST-77-9) Avail: NTIS HC A03/MF A01 CSCL 13B

Legislative background of the handicapped and elderly problem is presented. User groups are examined and system services characteristics are reviewed. An overview of equipment and service coordination issues are provided. Also included are a list of contacts and a bibliography. Author

N77-18975# Rhode Island Univ., Kingston. Dept. of Mechanical Engineering and Applied Mechanics.
MANGANESE AND IRON REMOVAL FROM WATER BY ADSORPTION ON DIATOMACEOUS EARTH Completion Report Jul. 1974 - Jun. 1975
Frank J. DeLuise Jun. 1976 16 p refs
(Contract DI-14-34-0001-6041)
(PB-258776/4; W77-00155; OWRT-A-053-RI(1)) Avail: NTIS HC A02/MF A01 CSCL 13B

A method to reduce the high resistance caused by oxidized manganese is investigated. Manganese and iron in water are oxidized under controlled conditions to form polymeric hydroxo complexes which are then adsorbed on diatomaceous earth and subsequently removed with the diatomaceous earth by a filtration process. Results with various grades and concentrations of diatomaceous earth are shown. GRA

N77-18976# Environmental Protection Agency, Washington, D.C.
DRAFT GUIDELINES FOR STATE AND AREAWIDE WATER QUALITY MANAGEMENT PROGRAM DEVELOPMENT
Feb. 1976 344 p
(PB-259507/2) Avail: NTIS HC A15/MF A01 CSCL 13B

Guidelines to assist the States in setting up a management program and institutional arrangements to integrate water quality and other resource management decisions are presented. Development and implementation of State Water Quality Management Plans so that the longer range goals of the Federal Water Pollution Control Act Amendments of 1972 can be met is emphasized. To achieve these goals, it will be necessary to develop a water quality management process at the State and local level that assures continuous planning for and implementation of pollution control measures. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N77-18977*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ANALYTICAL CALCULATION OF THE AREAS OF SATURN'S DISK AND RINGS
S. Matthews and E. F. Erickson Feb. 1977 7 p ref
(NASA-TM-X-73204; A-6906) Avail: NTIS HC A02/MF A01 CSCL 03A

The area of the visible disk, the area of the ansae (visible rings not overlapping the disk), and the area of overlap (visible rings overlapping the disk) were analytically determined to account for the thermal emission from the rings. These parameters were available in the ephemeris. Author

N77-18978# European Space Agency, Paris (France).
ULTRAVIOLET BRIGHT-STAR SPECTROPHOTOMETRIC CATALOGUE. A COMPILATION OF ABSOLUTE SPECTROPHOTOMETRIC DATA OBTAINED WITH THE SKY SURVEY TELESCOPE (S2/68) ON THE EUROPEAN ASTRONOMICAL SATELLITE TD-1
C. Jamar, D. Macau-Hercot, A. Monfils, G. I. Thompson, L. Houziaux, and R. Wilson Nov. 1976 501 p refs Prepared jointly with Inst. d'Astrophys., Cointe-Ougree, Belg.; Mons Univ., Belg.; UKAEC Culham Labs., Abingdon, Engl.; Roy. Obs., Edinburgh; Rutherford High Energy Lab.; Univ. Coll., London
(ESA-SR-27) Avail: NTIS HC A22/MF A01

Results from observations carried out by the S2/68 ultraviolet sky survey telescope aboard the ESRO satellite TD-1 are presented in tabular and graphic form. The data were obtained during the first observation period, from March 19, 1972, to October 31, 1972. The catalog is limited to the brightest objects, for which the signal is good enough to give valuable spectrophotometric information. ESA

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

No abstracts in this category.

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N77-18979*# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
LUNAR SAMPLE ANALYSIS Annual Report, 1 Feb. 1976 - 31 Jan. 1977
R. M. Housley 31 Jan. 1977 8 p refs
(Contract NAS9-11539)
(NASA-CR-151183; SC507.30AR; AR-5) Avail: NTIS HC A02/MF A01 CSCL 03B

The surface composition of lunar fines, the solar wind sputtering process, and the profile of reduced Fe in lunar samples are reported. Atomic absorption studies of trace metal, especially lead, distribution in lunar fines samples are described. Author

N77-18980*# Scientific Translation Service, Santa Barbara, Calif.
AEROSOL IN THE ATMOSPHERE OF JUPITER AND SATURN
V G. Teyfel Washington NASA Feb. 1977 22 p Transl. into ENGLISH from Priroda (USSR), v. 1, 1977 p 45-56
(Contract NASw-2791)
(NASA-TT-F-17520) Avail: NTIS HC A02/MF A01 CSCL 03B

Physical conditions in the atmospheres of planets depends to a significant degree on the presence of aerosol particles which manifest themselves significantly in the general thermal balance of the Jovian and Saturn atmospheres. The cloud covers of these planets reflect and backscatter into space nearly half of the radiant energy of the Sun that reaches the planets. The chemical composition of the atmospheres and of the cloud layers are discussed. Author

N77-18981*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
LUNAR SURFACE GRAVIMETER EXPERIMENT Final Report
John J. Giganti, J. V. Larson, J. P. Richard, R. L. Tobias, and J. Weber Jan. 1977 25 p refs Sponsored in part by the Computer Science Center, Md. Univ.
(Contract NAS9-5886)
(NASA-CR-151203) Avail: NTIS HC A02/MF A01 CSCL 03B

The lunar surface gravimeter used the moon as an instrumented antenna to search for gravitational waves predicted by Einstein's general theory of relativity. Tidal deformation of the moon was measured. Gravitational radiation is a channel that is capable of giving information about the structure and evolution of the universe. Author

N77-18982*# Joint Publications Research Service, Arlington, Va.
LUNA-24 SOIL SAMPLE FROM SEA OF CRISIS BEING EXAMINED
L. S. Tarasov and A. T. Bazilevskiy Washington NASA Mar. 1977 10 p Transl. into ENGLISH from Zemlya i Vselennaya (USSR), no. 1, Jan. 1977 p 18-22
(NASA Order W-13183)
(NASA-TT-F-17518) Avail: NTIS HC A02/MF A01 CSCL 03B

A regolith core was taken from the Sea of Crisis by Luna-24, to be examined for meteorite-bombardment ejecta from nearby mare areas. The packaging of the core sample and methods for its handling in the capsule and receiving chamber are described. Initial investigation of the sample shows that the cross section is not homogeneous. Author

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N77-18983*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AP-8 TRAPPED PROTON ENVIRONMENT FOR SOLAR MAXIMUM AND SOLAR MINIMUM
Donald M. Sawyer and James I. Vette Dec. 1976 176 p refs
(NASA-TM-X-72605; NSSDC/WDC-A-R/S-76-06) Avail: NTIS HC A09/MF A01 CSCL 03B

Data sets from Ov-3 and Azur indicate a need for improvement in models of the stably trapped proton flux with energies between 0.1 and 400 MeV. Two computer accessible models are described: AP8MAX and AP8MIN. The models are presented in the form of nomographs, B-L plots, R-lambda plots, and equatorial radial profiles. Nomographs of the orbit-integrated fluxes are also discussed. The models are compared with each other, with the data, and with previous AP models. Requirements for future improvements include more complete data coverage and periodic comparisons with new data sets as they become available. The machine-sensible format in which the models are available are described. Author

N77-18984*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
BACKSCATTER OF HARD X-RAYS IN THE SOLAR ATMOSPHERE
T. Bai (Maryland Univ., College Park) and R. Ramaty Jan. 1977 30 p refs Submitted for publication.
(Grant NGR-21-002-316)
(NASA-TM-X-71269; X-660-77-21) Avail: NTIS HC A03/MF A01 CSCL 03B

The solar photosphere backscatters a substantial fraction of the hard X rays from solar flares incident upon it. This reflection was studied using a Monte Carlo simulation which takes into account Compton scattering and photo-electric absorption. Both isotropic and anisotropic X ray sources are considered. The bremsstrahlung from an anisotropic distribution of electrons are evaluated. By taking the reflection into account, the inconsistency is removed between recent observational data regarding the center-to-limb variation of solar X ray emission and the predictions of models in which accelerated electrons are moving down toward the photosphere. Author

N77-18985# Explosives Research and Development Establishment, Waltham Abbey (England).
CONTINUOUS WORLD WIDE UV MONITORING PROGRAMME
A. Davis, G. H. W. Deane, and G. V. Howell Jun. 1975 37 p (ERDE-TR-190; BR52191) Avail: NTIS HC A03/MF A01

The program for monitoring solar UV by exposing polyphenylene oxide (PPO) film and measuring the degree of color change is discussed. The 1973 results from 24 sites throughout the world are presented, and a summary of all results to date is given. Author (ESA)

N77-18986# Boston Coll., Chestnut Hill, Mass. Dept. of Physics.
PREDICTING RIOMETER ABSORPTION FOR SOLAR RADIO BURSTS. 1: CORRELATIONS BETWEEN PROTON SPECTRA AND RIOMETER ABSORPTION
Pradip Bakshi and William Barron Jun. 1976 27 p refs
(Contract F19628-76-C-0008; AF Proj. 4643)
(AD-A030301; SR-1; AFGL-TR-76-0166) Avail: NTIS HC A03/MF A01 CSCL 03/2

Observed riometer absorption A (in db) is correlated with the proton spectrum variable (log I (=10 MeV) - alpha log Rho), where I(=10 MeV) is the peak flux of protons with energies in excess of 10 MeV, Rho is a measure of the average energy of these protons and alpha is an adjustable parameter. Study of the major proton events I(10 MeV) = 100 protons / sq cm /sec/ ster since 1967 shows excellent correlations. Even when the average energy dependent factor is ignored (alpha=0), our approach provides better correlations than the usual square root

relation; optimization over alpha further improves the correlations to r nearly equivalent to 0.97. A practical program for utilizing solar radio burst data for an early prediction of riometer absorption can now be developed by combining our previous studies on radio results from proton correlations with the proton results from riometer results reported here. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N77-18987*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE HIGH ENERGY X-RAY SPECTRUM OF THE CRAB NEBULA OBSERVED FROM OSO 8
J. F. Dolan, L. J. Crannell, B. R. Dennis, L. E. Orwig, G. S. Maurer, and K. J. Frost Jan. 1977 23 p refs Submitted for publication
(NASA-TM-X-71260; X-682-77-7) Avail: NTIS HC A02/MF A01 CSCL 03B

The X-ray spectrum of the Crab Nebula was measured with the scintillation spectrometer on board the OSO-8 satellite. The total emission of the X-ray source shows no long term variability. The spectrum itself can be described by a single power law out to energies of at least 500 keV. Author

N77-18988*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
X-RAY SIGNATURES: NEW TIME SCALES AND SPECTRAL FEATURES
Elihu Boldt Jan. 1977 43 p refs Presented at 8th Tex. Symp. on Relativistic Astrophys., Boston, 13-17 Dec. 1976 Submitted for publication
(NASA-TM-X-71267; X-661-77-8) Avail: NTIS HC A03/MF A01 CSCL 03B

The millisecond bursts from Cyg X-1 are investigated and the overall chaotic variability for the bulk of the Cyg X-1 emission is compared to that of Sco X-1, showing that the essential character is remarkably similar (i.e. shot noise) although the fundamental time scales involved differ widely, from a fraction of a second (for Cyg X-1) to a fraction of a day (for Sco X-1). Recent OSO-8 observations of spectra features attributable to iron are reviewed. In particular, line emission is discussed within the context of a model for thermal radiation by a hot evolved gas in systems as different as supernova remnants and clusters of galaxies. Newly observed spectral structure in the emission from the X-ray pulsar Her X-1 is reported. Author

N77-18989# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.
RELATION BETWEEN MONOPOLE MASS AND PRIMARY MONOPOLE FLUX Interim Report
John M. Cornwall and Henry H. Hilton 12 Aug. 1976 12 p refs
(Contract F04701-75-C-0076)
(AD-A030046; TR-0076(6260-20)-11; SAMSO-TR-76-192) Avail: NTIS HC A02/MF A01 CSCL 20/8

Quantitative results are given to show that the probability of observing a monopole at the earth with beta equal to or approximately 0.5 decreases as the monopole mass decreases for masses less than or approximately 10,000 GeV; the effective cross section of the earth is roughly the geometric cross section times the ratio of the monopole mass to 8,000 GeV. Author

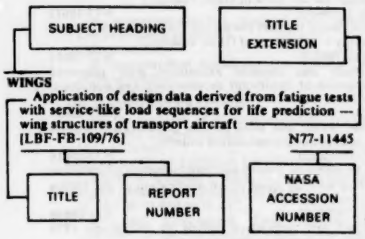
99 GENERAL

N77-18990# Advisory Group for Aerospace Research and Development, Paris (France).
AGARD BULLETIN: MEETINGS, PUBLICATIONS, MEMBERSHIP, JANUARY 1977
Jan. 1977 82 p
(AGARD-Bull-77/1) Avail: NTIS HC A05/MF A01

AGARD technical meetings for 1977 and a summary of the meeting themes are presented. Abstracts are given for the 1976 publications, as well as the list of AGARD members. S.M.

SUBJECT INDEX

Typical Subject Index Listing



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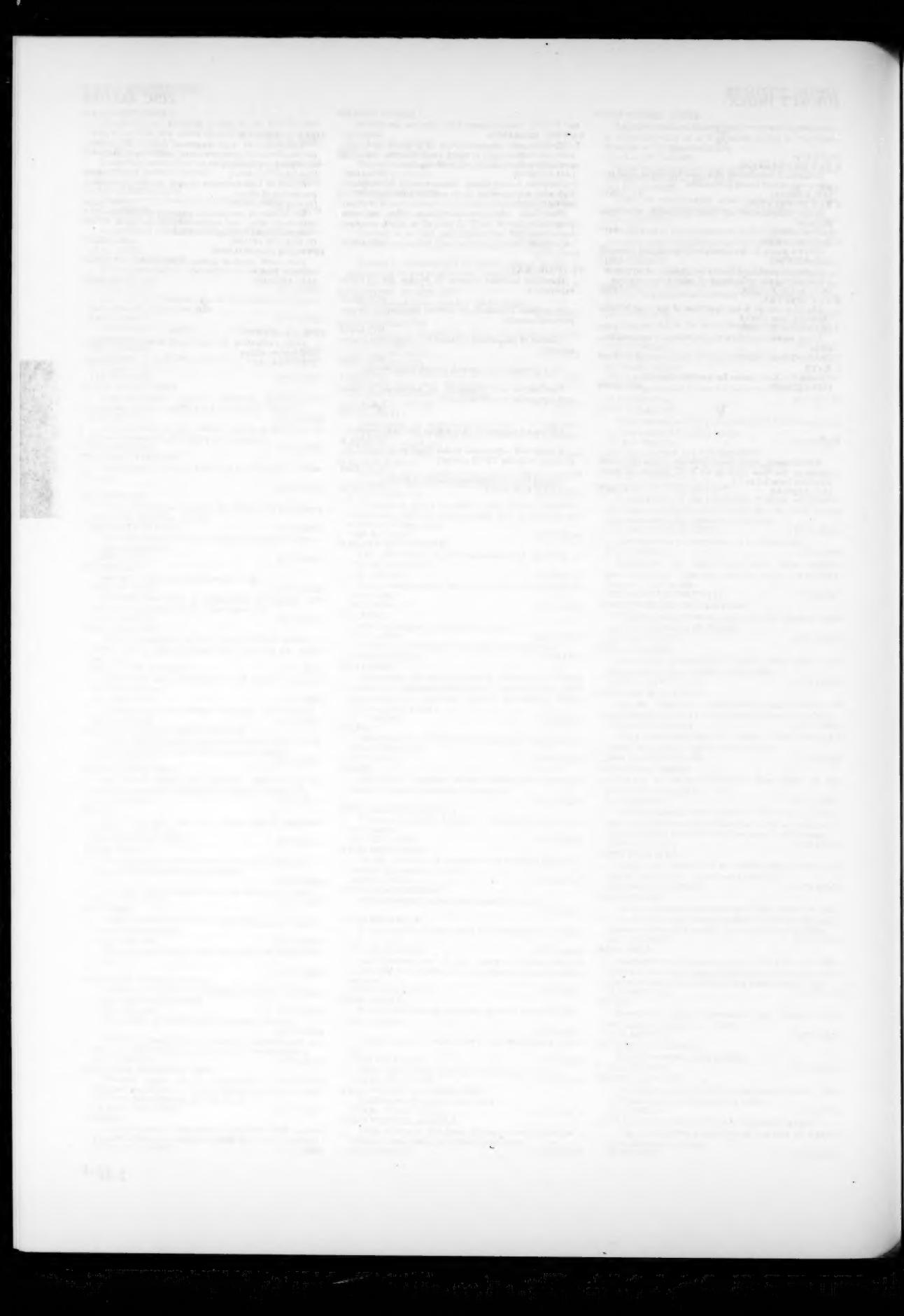

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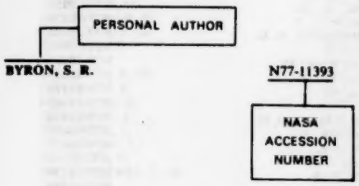

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DUNCAN, C. N.
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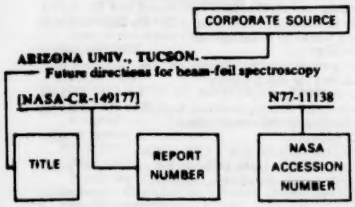

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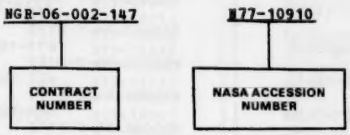

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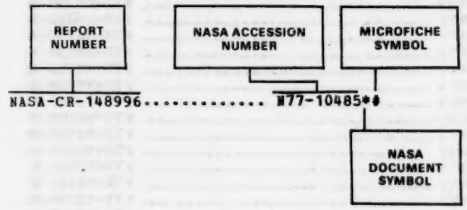

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